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NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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The Oils and Fats Industry

It will be generally agreed that, while during the past two years technical development in connexion with the preparation and use of oils and fats has been by no means at a standstill, the commercial and economic conditions have mainly attracted attention. Like so many other industries, that connected with the working up of edible oils had to contend with dislocation of an exceptional nature with the reversion to peace-time conditions. The exigencies of war demanded the intensive production of prepared food substances, so that manufacturing plant underwent enormous development. As a well-known example may be mentioned the fact that the present home capacity for producing margarine is said to have reached no less than four times the potential pre-war out-put. At one time it was commonly understood that the total world demand for oils and fats was probably in excess of supplies; but within the past year there has been,

largely as a result of falling prices, some considerable tendency to revert to natural food substances, and the problem of providing a sufficiency of raw products for manufactured foods, &c., does not now seem to be so pressing. Nevertheless there is an urgent need for investigation as to possible new sources of oils and fats, while finality can in no sense be said to have been reached so far as milling and recovery methods are concerned. A distinct branch of the subject which provides considerable possibilities—although at the moment it is difficult to draw any definite conclusions—is the synthetic preparation of fatty acids by the oxidation of petroleum or similar hydrocarbons. Once an economic solution for the production of fatty acids by this means is available the outlook from the point of view of synthetic edible substances may be considerably changed, while the choice of raw materials would be enormously widened.

In this issue of THE CHEMICAL AGE we are more particularly concerned with the technique of the oils and fats industry, and in dealing with this subject one must necessarily accord primary attention to the hydrogenation of oils in the presence of a catalyst. This particular branch of technology is still comparatively in its youth, and yet it has established itself with such rapidity that, apart from details, there are few striking developments which can be pointed to in quite recent practice. As to the present day position of the industry there is no one better qualified to express an opinion than Dr. E. B. Maxted, and in a particularly thoughtful article which he contributes to this issue it is made clear that both industrial and laboratory experience have within late years contributed substantially to a better understanding of the mechanism and course of the hardening process. Originally, it was contemplated that the main uses for hardened oils would lie in the manufacture of soap and candles; but modern developments in their employment in the edible fat industry are now of very much greater importance. Moreover, solutions have been forthcoming in connexion with many of the problems which at one time beset the production of edible substances. It is now possible to eliminate the last traces of the characteristic taste which was so frequently to be observed in hydrogenated oils, while the complete removal of the catalyst appears to present little difficulty.

Chemical Engineering Group

THE annual meeting and dinner of the Chemical Engineering Group (which was held last evening and of which a report will appear next week) indicated little, if any, falling off in the very useful activities of the organisation during the past year. Mr. J. Arthur Reavell has been re-elected chairman, Mr. H. Talbot, honorary secretary, and Mr. F. H. Rogers, honorary treasurer. Among the subjects to be dealt with was a proposed alteration of Rule 3, which, in the opinion

of the committee, tended to restrict the operations of the group. The object of the change is a possible increase in the number of elected members of the committee up to a maximum of twenty instead of ten. It is proposed that the members who normally retire under Rule 10 should continue to serve and that nominations be asked for an additional five, making a total of fifteen. A preliminary announcement is made of the next conference of the group, to be held during the annual general meeting of the Society of Chemical Industry in Glasgow in July, 1922. The subject for discussion will be "Evaporation and Distillation," and will be dealt with in an afternoon and an evening session, in co-operation with the Glasgow Section of the Society. A number of very interesting and extremely important papers will be presented, and experts in these subjects will attend and take part in the discussions. A number of data sheets, dealing with various matters of chemical engineering experience, are being printed and will be issued gratis to members during the next few weeks.

In the treasurer's report attention is drawn to the fact that instead of the deficiency of £164 for the year 1920 the accounts showed a balance in hand of £57 17s. 6d. for the past year. It is explained that the reason for this change in the financial position is to be found, not so much in increased support by way of subscriptions or donations, as in the drastic curtailment of expenditure. In particular, the issue of data sheets was not continued to anything like the extent contemplated, and it is regretted that this very important branch of the Group's work should suffer from lack of funds. The membership subscriptions for the year amounted to £421 1s., corresponding to a membership of 400 as against 427 in the year 1920. This is regarded as an extremely satisfactory result under the conditions prevailing during the year, although naturally an increase of membership would have been more satisfactory. The donations are considerably less than during the preceding year, largely because no appeal, such as had been previously put forward by various members of the committee and of the group, was repeated. At the same time it is gratifying to know the result of the special appeal to members contained in the hon. treasurer's report of the preceding year, although half of the deficiency—£89 instead of £164—was received. The Committee are extremely grateful to those members of the Group who assisted in meeting this debit balance. The support received from the Parent Society was similar to last year, and negotiations were in progress at the end of 1921 for securing additional help for the future. It is hoped that this will be successful, and that the Group may in consequence have greater resources for development during the coming year. The Committee anticipate that at the close of 1922 there will again be a credit balance to be recorded and hope to be able to develop the work of the Group much more vigorously in 1922 than has been possible during 1921.

The Future of Muscle Shoals

THE considerable amount of argument which has been waged round the possibilities of developing the Muscle Shoals nitrogen plant for commercial purposes has from time to time brought out some interesting suggestions and points in connexion with fertilizers. As is well known, this plant is designed to produce cyanamide, which is ultimately transformed into

ammonium nitrate. It is in connexion with the latter compound that much of the discussion has occurred, for although it might be employed to some extent in fertilizer products, and is, in fact, an excellent plant food, it possesses the disadvantage of being decidedly deliquescent. A number of experiments have been made in connexion with the possibilities of ammonium nitrate as an effective component of fertilizer products. Methods have been devised for oil-coating the substance, while research has been conducted to determine the suitability of double salts of sulphate and nitrate. It has been shown that the double salt is certainly less deliquescent than the nitrate, although it is not, perhaps, entirely satisfactory. Another method is that of mixing potassium chloride with the ammonium nitrate. In this case the two salts react together to form a mixture which is non-deliquescent; while still another method is to mix ammonium nitrate and potassium sulphate together.

Since the Muscle Shoals plant is primarily one for the manufacture of cyanamide, and since this is the cheapest form of nitrogen which it can produce, it may be a little difficult to understand why operations should not be permitted to stop here. In America, however, the opinion prevails that no great proportion of the output of the plant could be sold as cyanamide; and the material cannot be used in mixed fertilizers for the following reasons: If used in large quantities it reacts with the acid phosphate to destroy its availability, and it is likely to produce dicyanodiamide, which is a substance inimical to plant life. At the Fixed Nitrogen Research Laboratory experiments have been made which show that cyanamide can be more successfully mixed with basic phosphate and certain slags. With nitrogen prices such as are now prevailing it seems, however, that, if Muscle Shoals is to pay its way it must be worked up to full capacity; and, in the opinion of one leading American chemist, it can only be made a commercial success by being equipped for the manufacture of a variety of materials, including ammonium nitrate, ammonium phosphate, urea, and special chemicals of various kinds.

Increase of Palm Oil Yield

IN the French experiments in the application of scientific plant-breeding to the oil-palm, one of the main objects in view is the increase of palm oil yield and, therefore, of pulp or pericarp, at the expense of the kernel. Doubtless one of the most important factors in determining this line of research is the possibility of placing on the market a high grade edible palm oil. Hitherto a great deal of work has been done towards improving methods of palm oil refining in Europe; but it is now generally recognised that the best policy is to tackle the problem at its source, and obviate the need for subsequent refining by using better methods of harvesting, &c., on the plantations. Ammann showed in 1918 that an almost neutral oil can be prepared by using fresh unfermented fruits only and, more recently, the Dutch worker, Van Heurn, has published the results of investigations carried out at the General Experimental Station in Sumatra, organised by the Algemeene Vereeniging van Rubberplanters ter Oostkust van Sumatra (the A.V.R.O.S.). The work is described in the Med. van het, Algemeen Proefstation der A.V.R.O.S. Algem. Serie, No. 8, 1920. The causes of acidity in palm oil have been thoroughly investigated in West

Africa during the past few years, and most of Van Heurn's results have probably been anticipated. These results are, briefly, as follow :

(1) The bunches, while still on the trees, contain loose ripe fruits, and these loose fruits yield an oil with high acidity. The decomposition of the oil starts at the surface of the loose fruits and is accelerated by moisture and the growth of bacteria. But if these loose fruits are immediately removed and stored in the open the acidity is greatly reduced. (2) Ripe fruits which have fallen and been allowed to remain on the ground are, of course, apt to ferment. (3) If the fruits are bruised and damaged in harvesting, storage, or transport, and the cells broken, enzyme action and decomposition at once begin and acidity increases. (4) If the pulp is thoroughly heated before being separated from the fruit the lipolytic enzymes are destroyed, but if insufficiently heated, fermentation sets in, with production of fatty acids. (5) The fruits must be carefully graded and stored. This precaution is fairly obvious, and the best measures to adopt to prevent acidity due to factors (1) to (4) will also be sufficiently clear. Van Heurn recommends that each workman should be given charge of a definite portion of the estate, for which he would be entirely responsible. This, in his opinion, would be much better than the present group working.

Taxation and Chemical Industry

A MOST striking illustration of the ruinous effect of the present unprecedentedly high rate of taxation on British industry was furnished by Mr. Max Muspratt at a meeting of the shareholders of the United Alkali Co., Ltd., on Tuesday. However necessary this taxation might be in principle he was convinced that when it became necessary to pay, as they had done, £796,000 in taxation in two years the need for considerable reductions in this direction was imperative. It meant that for every pound paid to their debenture and share holders, the company had had to meet 23s. in taxation; this made it impossible to do justice to shareholders without serious detriment to the interests of the company. Mr. Muspratt, however, expressed himself in fairly confident terms regarding the future, given a conclusion of the deadly drain of taxation and an approximate stabilisation of values.

On the other hand, financial and technical difficulties appear to be, in a great measure, responsible for the trading loss of £758,415 disclosed by the British Cellulose and Chemical Manufacturing Co.'s accounts for 1921. The former will, it is hoped, be met by means of a scheme for the reorganisation of the company's capital, while the latter, which appear to have arisen over the dyeing of acetyl silk, should be disposed of by the expert assistance which it is proposed to engage. Meanwhile, the results of Professor Green's researches at Manchester, culminating in the discovery of a new class of dyestuffs called "ionamines" should be of considerable use in helping to place the manufacture of cellulose acetate silk on a commercial basis.

Unemployed Graduates

THERE is an interesting conflict of testimony on the subject of the commercial demand for University men in the reports of the appointment boards of London and Cambridge Universities. The London report states that trade depression has told seriously against the desired increase of opportunities for graduates

in commerce and industry, and it refers especially to the great difficulty experienced in doing anything to further the interests of graduates seeking employment in industrial engineering and chemistry. On the other hand, the Cambridge report states that while the board's work on the industrial and commercial side has been hampered by the prevailing conditions, especially in regard to engineering and the technical branches of industry, the supply of chemists and physicists is still too small for the demand, the training of those in residence since the war being not yet completed. Does this mean that while the market for all candidates short of the first class is distressingly overcrowded, there is still, even in the present conditions, plenty of room at the top? We hope it may be possible to put such a question without suggesting any invidious distinctions.

Points from Our News Pages

Special articles are published on "The Hydrogenation of Oils" (Dr. E. B. Maxted), "The Coalescence of Solids" (A. A. Pollitt); and "The Oil Palm and Plant Breeding" (p. 542).

Details are given of the re-organisation scheme of the British Cellulose and Chemical Manufacturing Co., Ltd. (p. 555). The effect of high taxation on trade was referred to by Mr. Max Muspratt at the annual meeting of the United Alkali Co., Ltd. (p. 558).

Opportunities for the development of British chemical trade in India are indicated by Mr. T. M. Ainscough (p. 551).

In our London Market Report prices are described as on the whole steady and the undertone as healthy (p. 565).

In our Scottish Market Report business during the past week is reported to have been fairly satisfactory (p. 567).

The Calendar

May 1	London Section of Society of Chemical Industry: Annual Meeting.	Burlington House, Piccadilly, London.
1	Photographic Fair opens.	Royal Horticultural Hall, London.
2	Institution of Chemical Engineers: Inaugural Meeting, 8.30, and Dinner, 7 p.m.	Hotel Cecil, London.
2	London County Council Lectures: "Crystal Structure." Professor Sir W. Bragg. 6 p.m.	University College, London.
3	Royal Society of Arts: "The Production of Titanium Oxide, and its use as a paint material." N. Heaton, B.Sc.	John Street, Adelphi, London.
3	Society of Public Analysts: Ordinary Meeting. 8 p.m.	Burlington House, Piccadilly, London.
4	Chemical Society: Ordinary Scientific Meeting. Papers by I. E. Balaban, F. L. Pyman, E. P. Perman, E. C. C. Baly, H. M. Duncan, I. M. Heilbron, and D. P. Hudson. 8 p.m.	Burlington House, Piccadilly, London.
4	University of Sheffield: "The Preparation of Coal for the Market." F. S. Sinnatt. 5.30 p.m.	The University, Sheffield.
5	Royal College of Science Chemical Society: "Passivity." H. L. Riley. 5 p.m.	Royal College of Science, London.
5	Society of Chemical Industry, Manchester Section: "Progress of Oil Extraction and Kindred Trades." R. A. Bellwood. 7.30 p.m.	The Textile Institute, Manchester.
8	Chemical Industry Club: "Chemical Progress: Some impressions of twenty-five years." Dr. E. F. Armstrong.	2, Whitehall Court, London.

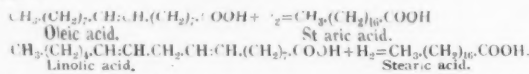
The Hydrogenation of Oils

With Special Reference to the Present-day Position of the Industry

By Edward B. Maxted, D.Sc., Ph.D.

THE first decade of a revolutionary chemical process—and the catalytic hydrogenation of oils undoubtedly possesses good claims to be considered to be within this category—is usually a period during which a relatively large bulk of often conflicting data becomes reduced, by a process of elimination and simplification, to certain more or less generally accepted working rules. At the same time, the plant employed becomes standardised to a small number of generally used types. The very large tonnage of oils now hardened annually, combined with the relatively small number of fresh patent specifications which have been issued during the past year or so—in contrast to the large number taken out during the initial development of the industry—is symptomatic of the application of this process of elimination, and of a healthy growth along those lines which have been found in practice to give the best results, and from which radical deviation is not likely. The period in question is, further, one in which a better understanding of the mechanism and course of the process, from a physico-chemical and theoretical aspect, has been gradually obtained, both by means of industrial experience and by work carried out under laboratory conditions. At the same time, the reaction, in addition to supplying artificial stearin for soap and candle manufacture, now plays a highly important part in the edible fat industry.

From a technical aspect, the hardening operation consists principally in the synthesis of tristearin by the interaction of the glycerides of less saturated C_{18} fatty acids and hydrogen, in the presence of a nickel catalyst. Thus, with oleic or linolic acids, both of which, in the form of glycerides, are important constituents of natural oils, the following reactions occur:



To this end, the heated oil, usually containing finely divided nickel in suspension, is brought into intimate contact with hydrogen. Absorption of this gas takes place, and the nickel is subsequently removed by filtration.

Temperature of Reaction

Turning to a more detailed consideration of the modern development of the process, the first point of interest to be considered is that of reaction temperature. In the early days of oil hardening, the use of temperatures in the neighbourhood of 200°C . was common, and, in some descriptions, temperatures even of 250° – 260° were mentioned. It has now been recognised that a nickel catalyst, when properly made, will catalyse the reaction between oil and hydrogen at temperatures far below this, and that the use of such high temperatures, far from being advantageous, is actually harmful to the quality of the product and to the life of the catalyst. Under certain conditions, nickel may even be active for catalytic hydrogenation at ordinary temperatures. Thus, Kelber¹ has shown that a catalyst prepared by reducing basic nickel carbonate with hydrogen at 310°C . readily induces the hydrogenation of unsaturated organic bodies in alcoholic or aqueous solution at room temperature. In the case of unsaturated glycerides, apart from the use of a solvent, the utilisation of temperatures below the melting point of the fat produced is not possible, owing to the rapid masking of the catalytic surface by a layer of solidified product; and, in any case, the activity of nickel at temperatures below 50° is not high. The hardening of oils under technical conditions

begins to be possible at about 60°C ., and the reaction proceeds at 80° with sufficient velocity for this temperature to be used commercially, at any rate with pure oils, if for any reason the advantages attendant upon the use of an abnormally low temperature should outweigh the disadvantage of a relatively long reaction period. From 80° the velocity of reaction increases gradually to a maximum situated at about 170° and, from this point, falls once more. The relative activity of a nickel catalyst for the temperature range 80° – 250° , the first portion of the curve, namely, from the lower limit to the point of maximum activity, being of special interest technically, is given graphically in Fig. 1. The values are based

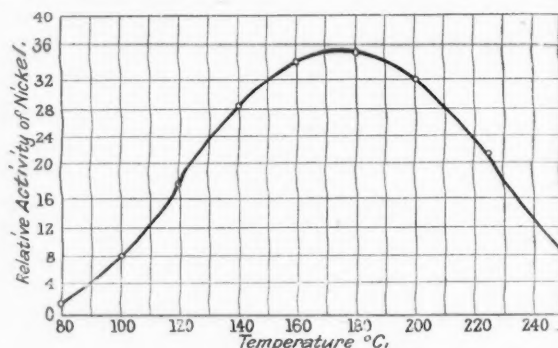


FIG. 1.

on results obtained by the author¹ for the hydrogenation of olive oil, and, while the figures will vary somewhat for different oils, and even for catalysts prepared in various ways, they may be taken as being typical of what occurs in practice with ordinary oils, and with nickel reduced at 300° to 325° from its oxide or carbonate.

It will be seen from the above figures,² that the use of temperatures in excess of 170° is not desirable, even from the point of view of the reaction velocity. A further and more important argument against the use of excessively high temperatures is to be found in the gradual diminution in activity of the nickel catalyst, even in the absence of catalyst poisons, owing principally to the masking action of a film of nickel soap, formed by the interaction of the catalyst with traces of fatty acids present in the oil or produced during hydrogenation. This effect becomes particularly pronounced at high temperatures, and for this reason the linear reaction course, which Armstrong and Hilditch³ have shown to be typical of pure substances, becomes, under the conditions employed in practice, usually curved, even with pure oils and pure hydrogen, this being particularly the case at high temperatures. Thus, while at 100° , with pure materials, the rate of absorption of hydrogen by an unsaturated glyceride such as olein, has a constant value, independent of the volume of hydrogen previously absorbed—up to a stage in the neighbourhood of saturation, where a point of inflexion occurs and absorption ceases rapidly—at 150° , and still more at 200° , the reaction graph, representing the volume of hydrogen absorbed plotted against the time, is curved; and the curvature at any point, measured by the rate of change of the slope of the tangent to this curve at a given time during the course of

¹ J. Soc. Chem. Ind. 1921, 40, 169T.

² Cf. also Moore, Richter & van Arsdell, J. Ind. & Eng. Chem. 1917, 9, 451.

³ Proc. Roy. Soc., A, 1919, 96, 137, 322; 1920, 98, 27.

¹ Ber. 1916, 49, 55.

the reaction, expresses the rate at which the catalyst is being poisoned. In the presence of definite catalyst poisons, such as organic sulphur or phosphorus compounds, the temperature employed may be influenced by any variation in the toxicity of the poison in question with change of temperature. This would seem to be the case for carbon monoxide poisoning, in that carbon monoxide is apparently less injurious at abnormally high temperatures, for instance at 250°-260°. Two other reasons for the use of as low a temperature as is compatible with reasonable working may also be mentioned, these being, firstly, that a relatively low temperature is found in practice to be conducive to the production of a good flavour in fats destined for edible products. A possible additional reason concerns the destruction of vitamins by high temperatures. This last point is put forward tentatively only, and is a subject on which definite experimental data, in the case of hardened oil, have, as far as is known, not yet been obtained. Determinations of the relative values for the vitamin content of an oil hardened at 60°-80°C., compared with one hardened, say, at 150°-200° would be of great interest in view of the extent of the edible fat industry.

The Role Played by Oxygen

During the period immediately prior to the war, a hypothesis was developed which ascribed the activity of an ordinary nickel catalyst to the presence of a suboxide of nickel, obtained by the incomplete reduction of nickel monoxide or sesquioxide. The principal reason for this assumption lies in the observation that, on reducing nickel oxide with hydrogen at a moderate temperature (*circa* 300°) and plotting the activity of the product, in various stages of reduction, against its oxygen content, it is found that the point of maximum activity does not correspond with complete reduction, but to a stage at which a considerable amount of oxygen still remains in the product. In opposition to this suboxide theory, it has been pointed out that nickel catalyst which has been subjected to prolonged reduction or to an excessive temperature, in addition to possessing a low oxygen content, also possesses a low catalytic surface, owing to sintering and to the aggregation of the finer particles of nickel. While a detailed discussion of the present position of the suboxide theory cannot be given in an article of the present scope, it may be noted, firstly, that no active oxide of nickel has been prepared without the use of such conditions that partial reduction to metal was also possible; and, secondly, that it has recently been shown by Elder¹ that even block nickel may be made catalytically active by reducing it to a fine powder by mechanical means. It is also noteworthy that if the aggregation of the particles of nickel be hindered by precipitation on to a porous support,² a far higher reduction temperature and consequently a more complete reduction to metal is found to be conducive to the production of a catalyst of optimum activity than is the case when sintering is not prevented.

In any case, however, quite apart from any question as to whether or not the connexion between the relatively high activity of partially reduced catalysts and their unreduced oxide content involves a fallacy of the *non causa pro causa* type, traces of oxygen would appear to play a part reminiscent of the rôle played by traces of water in many chemical reactions, the available evidence being particularly strong for metals, such as platinum, which are readily obtained free from the last traces of oxide and at the same time catalytically active. It has been shown by Willstaetter and Jacquet³ and by Willstaetter and Waldschmidt-Leitz⁴ that by careful removal of the last traces of oxygen from platinum or palladium catalysts, these become inactive even for the hydrogenation of compounds which are normally very easily reduced. The normal activity of the catalyst could, however, be restored by treatment with oxygen or by using hydrogen containing

a trace of oxygen.¹ Similar results were observed for nickel, but Kelber² was unable to confirm these. In this case, in view of the high technical importance of nickel, combined with the difficulty in preparing an active catalyst free from the last trace of oxide, further work appears to be desirable in order to determine conclusively this highly interesting point.

Catalysts

Of the catalysts which have come into common use, those prepared by the dry reduction of nickel oxide or carbonate, either alone or in conjunction with a porous support, are the oldest, and are, at the present time, probably far more widely used than any of the other forms. They are prepared on a commercial scale by precipitating a solution of a nickel salt, usually the sulphate or, less commonly, the nitrate by means of sodium hydroxide or carbonate. The sludge of nickel hydroxide or carbonate is formed by means of a filter press into compact cakes, which are washed in the press before removal. These are subsequently dried in a current of warm air, ground and, finally, reduced with hydrogen at a temperature of 300°-350°C. It is noteworthy, in view of the poisonous nature of sulphur in the sulphide or H₂S form, that sodium sulphate, as such, not only exercises no injurious effect on the activity of a nickel catalyst,³ but that the addition of sodium sulphate has even been suggested as a carrier for the nickel.⁴ There is, therefore, little need to wash the filter-cakes of nickel hydroxide, &c., until they are quite free from soluble sulphate, and it is generally accepted that nickel sulphate forms an equally suitable raw material for the manufacture of nickel catalyst as the more expensive nitrate. The non-poisonous nature of sulphur in the sulphate form is analogous to the lack of inhibitive action of phosphorus as phosphate, or of arsenic as arsenate, in the catalytic oxidation of sulphur dioxide to trioxide. In this connexion, it may be noted that Bosch, Mittasch, and Schneider⁵ recommend calcium phosphate as a promoter for nickel for the hydrogenation of oils. Many instances of other promoters for use in catalytic hydrogenation are cited by the Badische Anilin u. Soda Fabrik in Brit. Pat. 2306 of 1914, among these being the oxides or oxygen salts of the earth metals, including the rare earths (but exclusive of calcium, barium and strontium), also similar compounds of beryllium, magnesium, manganese, uranium, vanadium, niobium, tantalum, chromium, boron, or titanium; further, difficultly soluble phosphates, molybdates, tungstates or selenates, but the use of such or similar promoters has not come into general use. The use of supports of various natures for increasing the catalytic surface is, however, fairly common, and, as a variation in the ordinary method of precipitating the nickel in a hydroxide or similar form on to the porous carrier, this may be contained as a chemically combined component in the material used for the preparation of catalyst, for instance, by using nickel borate or silicate. Thus, the Mueller Speisefett A.-G.⁶ propose the employment of a mixture of nickel borate and carbonate, obtained by precipitating a soluble nickel salt with a mixture of sodium carbonate and borax, while Grote⁷ recommends a double silicate of nickel and magnesium, prepared by precipitation. Reference may also be made to Brit. Pat. 147578, in which the manufacture and use of a similar catalyst is described. In each case the catalyst is reduced with hydrogen before it is mixed with the oil.

A further class of catalysts exists, which require to be reduced in the oil itself, either during or prior to the hardening operation. The process dates from the patent of Bedford

¹ See also Boeseken & Hofstede, *Proc. K. Akad. Wetensch.*, Amsterdam, 1917, 29, 424.

² Ber. 1921, 54, 1701.

³ Moore, Richter & van Arsdell, *loc. cit.*

⁴ Wimmer, *Seifens. Ztg.* 1914, p. 390.

⁵ U.S. Pat. 1215335.

⁶ Brit. Pat. 148111; ex THE CHEMICAL AGE, Vol. III., p. 455.

⁷ *Seifens. Ztg.* 1920, 47, 713; ex J. Soc. Chem. Ind. 1921, 40, 397A.

¹ U.S. Pats. 1331903-4, see also *Chem. & Met. Eng.* 1920, 22, 793.

² Kelber, *loc. cit.*

³ Ber. 1918, 51, 767.

⁴ *Ibid* 1921, 54, 113.

& Williams,¹ and in the original or in a modified form is still employed to a certain extent. The chief disadvantage is that the charge has to be heated to an abnormally high temperature (250°-260°) in order to reduce the catalyst, before the hydrogenation can be effected. In place of nickel oxide, many inorganic or organic salts, for instance, the formate, have been suggested, but in view of the high cost of most of these, their use does not appear to have found favour. Finally, in order to reduce somewhat the temperature required for the reduction of such catalysts, certain other oxides or salts, in addition to nickel, may be incorporated with the catalyst. A well-known patent specification dealing with an effect of this nature is that of Dewar and Liebmann,² who have pointed out that nickel oxide containing, for instance, about 10 per cent. of copper oxide is far more easily reduced than nickel oxide alone.

Catalyst Poisons

The earliest inhibitors recognised for the hydrogenation of oils were hydrogen sulphide, phosphine, arsine, the halogens, and carbon monoxide. An interesting case of sulphur poisoning occurs in the frequently observed inhibitive action of albumenoids. In such a case the action may be due either to the evolution of hydrogen sulphide as a decomposition product of the albumenoid substance, or to poisoning by this directly. The presence of free fatty acids in oils intended for hydrogenation is undesirable, since, as already mentioned, a coating of inactive nickel soap is formed on the surface of the catalyst during hydrogenation. In place of removing fatty acids by means of soda in the ordinary way, prior to hydrogenation, Ellis³ has proposed the addition of glycerine to the charge itself, while Bolton and Lush⁴ recommend a mono- or di-glyceride for the same purpose. The inhibitive action of certain metals is noteworthy. In many cases, the phenomenon has been studied with catalysts of the platinum group, but the results are probably also valid to a certain extent for nickel. Paal and Karl⁵ showed that on using a number of finely divided metals as supports for a platinum or palladium catalyst, the resulting product is without activity; further⁶ that traces of mercury exercise the same effect. The quantitative side of the poisoning of catalysts by foreign metals has been studied by the author,⁷ who found that for the greater portion of the poisoning curve, a linear relationship exists between the poison content of the system and the degree of inhibition. In connexion with the use of solvents for the extraction of oils intended for hydrogenation, it is to be noted that these frequently contain traces of inhibitors which prevent a satisfactory hardening of the extracted product. The same caution applies to the use of solvents for any necessary cleaning of the hydrogenation plant itself.⁸

Plant

While a detailed discussion of the evolution of hydrogenation plant cannot be attempted here, a few remarks may perhaps be made on modern tendencies. The original bubbling method of Normann, improved in such a way as to give a more intimate degree of contact between oil and hydrogen, still underlies the construction of many plants in commercial use. In this connexion a recent patent of the American Cotton Oil Co.⁹ may be cited. The oil to be hardened is contained in a vessel provided with a porous false bottom, through which hydrogen is forced. The plant appears simple, and, provided that clogging of the porous

diaphragm can be avoided, should result in an even distribution of hydrogen in a finely divided condition. Wells¹ has suggested a plant of the bubbling type, in which the requisite fine subdivision of the hydrogen is effected by violent stirring at the point of entrance of the gas. The use of mechanical agitators in hardening plant, although proposed in a large number of patent specifications, is by no means necessary for the proper emulsification of the oil and hydrogen, this being more simply and satisfactorily effected in the majority of modern plants by injector or baffle action, in such a way as to eliminate moving parts. The use of sprays, whereby the oil is injected into an atmosphere of hydrogen, is referred to at some length in the earlier patent literature of the subject, but the type has, as far as is known, only survived as an adjunct to other means of bringing oil and hydrogen into contact. The principal plant of this type in common use is that of Wilbuschewitsch.²

Finally, while the generally adopted procedure consists in employing a finely divided catalyst, which is removed from the vessel, together with the oil, at the end of each hardening operation, many attempts have been made to carry out the process in such a way that the catalyst remains in the vessel. Most of the proposals having this object in view relate to the employment of stationary surfaces of compact nickel, over which an emulsion of hydrogen and oil is passed, but the type of plant has apparently not come into use to any large extent, probably on account of the gradual decrease in activity of the nickel surface. In a recent patent specification of the Soc. Anon. l'Oxyhydrique,³ the separation of oil from a finely divided catalyst is effected by means of porous filtering tubes inserted into the reaction vessel. It is stated that choking may be prevented by passing oil through the tubes when filling the vessel, in the opposite direction to that used during filtration.

Uses of Hardened Oils

During the early development of oil hardening, the uses chiefly contemplated were for the manufacture of soap and of candles, to which end—since the product consists substantially of synthetic stearin—hardened oils are very suitable. The greater portion of the materials hardened during these early stages consisted of whale or linseed oil, and much information concerning the properties and use of these oils for soap-making was published, particularly in Germany, during the period immediately prior to the war (see, for instance, the *Seifensieder Zeitung* and similar papers from about 1911 to 1914). In any case, the amounts hardened were substantial, it being estimated⁴ that the total pre-war capacity of the European plants (including the United Kingdom) was about 250,000 tons per annum, about half of this capacity being actually hardened. In addition to the use of hardened oils for soap and candles, modern developments in their employment in the edible fat industry are of the highest importance. In this connexion it may be of interest to quote, as an example, the increasing output of an edible product consisting substantially of hardened cotton seed oil by one American firm alone⁵ for the six years prior to and including 1916, the figures given being approximate only:

Year.	Tons Produced.
1911	1,200
1912	6,500
1913	10,500
1914	18,000
1915	21,000
1916	28,000

This use of hardened products for edible purposes is becoming yearly of increasing importance, particularly in

¹ Brit. Pat. 2520/07.

² Brit. Pats. 12981 & 12982 of 1913.

³ U.S. Pat. 1228888.

⁴ Brit. Pat. 162382; ex THE CHEMICAL AGE, Vol. IV., p. 653.

⁵ Ber. 1911, 44, 1013; 1913, 46, 3069 & 4010.

⁶ Paal and Hartmann, Ber. 1918, 51, 711; Paal & Steyer, *ibid.*

1743.

⁷ J. Chem. Soc. 1920, 117, 1501; 1921, 119, 225.

⁸ Ulzer, Oel- & Fett-Ind. 1920, p. 367; ex J. Soc. Chem. Ind.

1920, 40, 477A.

⁹ Brit. Pat. 175021, ex THE CHEMICAL AGE, Vol. VI., p. 352.

¹ U.S. Pat. 1383887.

² Brit. Pat. 30014-10.

³ Brit. Pat. 143848.

⁴ Oil, Paint & Drug Rep., Feb. 2 and Oct. 19, 1914.

⁵ Quoted in C. Ellis, *Hydrogenation of Oils*, 2nd rev. Ed., p. 635.

view of the highly satisfactory elimination of the last traces of the characteristic taste often observed in hydrogenated oils and particularly in those treated at a high temperature. The complete removal of catalyst presents little difficulty, and the products, in addition to being used directly, find an application in the manufacture of lard compound and of margarine.

In conclusion, it may be noted that there seems to be a growing tendency towards hardening the oils as near as possible to the locality in which they are produced. In this way difficulties owing to rancidity or similar processes are minimised, and the hardened products are usually far less susceptible to change than the original liquid oils.

The Coalescence of Solids

By A. A. Pollitt, M.Sc.

THOUGH most of us are familiar with the fact that when two small drops of a pure liquid are brought into contact they run together and form a larger drop, the experience has received, in the majority of cases, at the most merely a passing consideration, and has been accepted as an instance of a simple natural phenomenon. If, however, a little more thought is given to the subject a simple and perfectly sound conclusion is very soon reached, namely, that the two smaller drops are unstable with respect to the larger drop. If this is accepted, then we can go further and say that since a small drop is unstable in respect to a larger drop, we should expect a small drop to distil over to and condense on a larger drop, or, in other words, the smaller the drop the greater is the vapour pressure, that is to say, the vapour pressure varies with the curvature of the drop, increasing with increase in the latter.

This conclusion was reached, though in a different manner, by William Thomson (*Phil. Mag.*, 1871, 4, 42, 448). If we take a capillary tube dipping into a liquid and enclose the whole in a vessel containing only the liquid and its vapour, the raised liquid surface in the capillary must be in equilibrium with the main surface of the liquid if the whole of the system is at a constant temperature. The vapour pressure varies, however, at different levels owing to gravity; hence the concave surface of the liquid meniscus must have a lower vapour pressure than the plane surface of the liquid. Conversely it must be true that the convex surface of a drop must have a higher vapour pressure than the plane surface of the liquid, and this difference will be greater the greater the curvature of the surface, or, in other words, the smaller the drop. These differences in vapour pressures are, of course, very small, but they can be demonstrated experimentally (Bacon, *Phys. Rev.*, 20, 1, 1905).

Whilst we all have observed the coalescence of small liquid drops, we have had little experience with regard to the coalescence of solids, although very finely divided solids behave in many respects like finely divided liquids. Very finely powdered material must have a higher vapour pressure, a greater solubility, and a lower melting-point than the same material in bulk or in a coarse crystalline condition. Jonstorf kept small crystals of iodine, 2 to 3 millimetres in diameter, for eight years in the dark at a temperature of 0° to 24°, and found that at the end of that time the smaller crystals had mostly disappeared and that the diameter of the crystals had increased to from 4 to 5 millimetres. Pawlow (*Zeit. Phys. Chem.*, 65, 1, 1908 : 68, 366, 1909) found that crystals of salol 2 μ in diameter had a melting-point 1.1° lower than that of crystals of 40 μ diameter. Comparisons between a fine dust of less than 2 μ diameter with crystals of 0.5 to 2.0 millimetres diameter showed differences of from 4° to 7° in melting-point in the cases of salol, antipyrin, and phenacetin.

With regard to the effect of particle size on solubility there is a difference in the solubility of calcium sulphate of nearly 20 per cent. in changing the grain size from 2 μ to 0.3 μ . Barium sulphate having a grain size of 1.8 μ was found to be soluble to the extent of 2.29 milligrammes per litre at 25°, whilst the solubility corresponding to a grain size of 0.1 μ was 4.5 milligrammes per litre. The foregoing instances will suffice to show the influence of the particle size on general physical properties, although many others might be quoted.

This similarity between small solid particles and small liquid drops would seem to indicate that the failure to cause the coalescence of solid particles may be due to faulty experimental technique. If copper is deposited or precipitated electrolytically on to copper, a mass results which does not differ materially in properties from cast copper having the same size of crystals. The successive layers of deposited copper coalesce to a solid mass. If, however, we attempt to electroplate nickel on to nickel, we obtain a film of nickel which is not adherent, unless special precautions are observed which consist essentially in removing the oxide film which exists on the nickel cathode. If this precaution is taken the deposited nickel will appear as an adherent or coalesced film. The obvious reason of the failure in the first case is simply because the deposited nickel never came into actual and intimate contact with the cathode. When a plate is broken cleanly, that is without chipping, the two pieces will fit together perfectly, and should cohere, showing no signs of a break. This does not happen, of course, because of the film of condensed air which, acting as a cushion, prevents actual contact being made between the pieces. It may be argued from this that if the plate were broken in an absolute vacuum and the pieces there brought together again the plate would theoretically become whole once more. Proof of this cannot be obtained since it is not possible to produce an absolute vacuum.

If the temperature is raised other factors are brought into play, the material is likely to become more malleable, and in consequence it is easier to make contact at a number of points. Also, at higher temperatures less gas is adsorbed, and it is held less firmly. It is easy to make two pieces of glass unite at temperatures at which the glass is still very viscous, and although criticism may argue that glass in this condition is a fluid, this argument cannot be applied to platinum, which can be welded at a temperature very far below its melting-point and at which it is unquestionably solid. The two pieces of platinum are united under these conditions by a light tap with a hammer. In these instances it will be seen that it is important to ensure intimate contact between the pieces of like material, and it is easy to explain the necessity of having clean surfaces when welding and brazing and consequently the function of fluxes.

Other instances of cohesion between the surfaces of like material may be found in unvulcanised rubber, bitumen, and in the following observation made by Willows and Hatschek, who found that it was possible to polish copper to such an extent that a cube of the metal will support eleven others which are merely placed in contact with it. Glass surfaces can readily be so polished that when placed in contact they adhere and show no more than one interference fringe when examined by the reflected light from their contact faces. Such surfaces may be brought into optical contact by the application of moderate pressure so that they behave optically as one piece. The two pieces can be separated by a shearing force or by a sudden alternation in temperature. It is possible, by careful selection of temperature and pressure, to weld such pieces and the deformation which results is so slight that a few strokes of the polishing tool is sufficient to remedy it. It has been pointed out also that freshly split

pieces of mica can be made to coalesce by merely pressing them between the fingers. If, however, the mica is not freshly split the exposure of the surfaces to the atmosphere, has resulted in the formation of a film of adsorbed gas or moisture and the coalescence of the pieces cannot be effected as just described. It would appear, however, that even when a film of condensed gas is present on the surfaces, if the pressure applied be sufficient to expel the gas, the surfaces will coalesce; thus many powders can be moulded into large blocks by the application of sufficiently high pressures. Some powders, when heated, coalesce to a certain extent under the influence of gravity alone. This is generally known as "sintering" or "fritting," and although these terms are used synonymously there is a distinction between them which should be observed. "Sintering" defines those cases of coalescence which occur without fusion, or at the most with but very slight fusion, whilst "fritting" indicates that the produce is distinctly vitreous and that the coalescence has been accompanied by marked fusion. The production of bricks and pottery involves sintering, whereas the glaze imparted to them, like the production of glass, is the result of fritting. The higher the temperature the greater is the contraction or sintering and the denser the resulting solid. Bricks are less porous the higher the burning temperature, and lime and magnesia are denser the higher the calcining temperature. The sintering of tungsten and tantalum powders is a process which is carried out at a temperature far below the melting-points of the metals, and is apparently independent of the presence of impurities. If soot is heated for a long period or at a high temperature it becomes sandy, and the density of red phosphorus depends upon the heat-treatment whereby it has been produced. Many precipitates sinter on standing, though the change is usually referred to as agglomeration, and it is frequently accompanied by a decreased chemical activity. Strongly heated lime reacts very slowly with carbon dioxide, and whereas, after a brief ignition, silica is soluble in a boiling solution of potassium or sodium carbonate, it becomes insoluble after a prolonged ignition. When freshly precipitated, arsenic sulphide gives off a considerable quantity of sulphuretted hydrogen when boiled with water, but after ignition at 125° it ceases to react in this way. The action of alkali on hydroxides and of gelatine and ammonia or potassium bromide on silver bromide is considerably decreased if the precipitates are allowed to stand for a few hours.

A plastic substance is one whose shape can be permanently altered by pressure and in which any fracture due to deformation is self-healing. A mobile liquid is not plastic because it will not retain its shape, but liquids become plastic with increasing viscosity. Semi-fused glass is plastic, and, if the rate of deformation is slow, bitumen and sealing wax are also plastic, but if the pressure is applied quickly these latter materials at normal temperatures are brittle. Metals and other solids coalesce under high pressure, that is they are plastic under this condition, provided, of course, that a shearing force is also present. A practical illustration of this is to be found in the manufacture of rods and pipes by extruding the metals. Between such extreme cases of a liquid such as semi-molten glass and a solid such as a metal there are many intermediate cases of which putty may be mentioned. This consists of a solid (whiting), with a liquid film (oil) around it. When a liquid is adsorbed strongly by a solid, thin films of the liquid will hold the solid particles together although at the same time permitting them to move relatively to one another, and the tendency of the liquid surfaces to coalesce results in the healing of any break or fracture. A liquid film can act, therefore, as a bond for solids, and render the mass plastic. Oil and tar, for instance, are used as bonding materials in road-making, and everyone is familiar with the fact that wet sand can be moulded whereas dry sand cannot.

Preliminary experiments have been made to ascertain the concentrations at which plasticity begins and ends (Bingham,

Amer. Chem. Jnl., 46, 278, 1911). If a finely divided solid is added to a liquid the viscosity of the latter is increased, or its fluidity is diminished, and this property can be measured for instance, by a viscometer. At temperatures between 25° and 60°, it was found that the fluidity dropped to zero at the same concentration, so that over this range of temperature, at least, the concentration producing zero fluidity is independent of the temperature. With kieselguhr in water zero fluidity was reached at a volume concentration of about 13 per cent. solids, with China clay at about 4 per cent., and with the graphite used in Acheson's "aquadag" at about 5.5 per cent. of graphite. Mixtures having zero fluidity are not stiff and will not maintain their shape. At higher concentrations of solids there is a change from viscous flow to plastic flow, the distinction being that with viscous flow any shearing force, no matter how small, will produce permanent deformation, whereas with plastic flow it is necessary to have a shearing force of finite magnitude in order to produce a permanent deformation. It seems reasonable to assume that zero fluidity is reached when the proportion of liquid to solid is such that the particles of the latter are scattered, that is to say when the proportion of liquid is sufficient to fill the voids in the solid powder. Experiment lends support to this view. Thus, in a clay in which the voids totalled 81.6 per cent. of the volume, a mixture of zero fluidity resulted when the volume of water was 80.5 per cent. of the whole.

If the concentration which gives zero fluidity depends upon the volume of the voids, it is necessary to consider what this volume may be. If equal spheres are taken and are piled so that each sphere is directly on top of another, the voids constitute theoretically about 48 per cent. of the whole space occupied, irrespective of the size of the spheres. Such piling is known as cubical or minimum piling. If the spheres are now piled or arranged so that each one rests equally on the four in the layer below, maximum or hexagonal piling, the theoretical volume represented by the voids is in this case nearly 26 per cent. of the whole and is again independent of the size of the spheres. With solids of different shapes and sizes the voids may theoretically be made almost anything. If the solids have condensed air films around them so that they do not come actually into contact, the percentage of voids will increase with decrease in the size of the solids. Thus, in lamp black, they may figure at about 95 per cent. If the air adsorption were negligible, and the particles were cubes of the same size and arranged in an orderly manner, the voids would be practically nil. Round grained, water-worn sands have 2 to 5 per cent. less voids than sharp sand grains, simply because the former pack better.

The effect of moisture on sand is at first rather unexpected. Moist sand occupies more space and weighs less per cubic foot than dry sand, the explanation being that a film of water coats each grain of sand and separates it from its fellows, thereby increasing the proportion of voids. Since fine sand has a large number of grains per unit volume, and consequently more surface area, the addition of water to it causes a greater increase in bulk than in the case of a coarser sand. If a small quantity of water is poured into a vessel containing dry sand, the friction of the particles prevents the volume from increasing, but the increase occurs if the moistened sand is dumped out as may be seen by trying to return the whole of it into the original vessel. The percentage of water by weight which will give the greatest volume, corresponding to the largest percentage of voids, varies with different sands from 5 to 8 per cent. Since the densest mixture occurs with particles of different sizes it is clearly important that in making concrete, &c., the materials shall be so graded that the maximum density is obtained. On the other hand the sand grains for a sand filter should be of approximately the same size since if this is not so the filter will clog too quickly. The question has also been raised as to what are the correct sizes for the balls in a ball mill. There should probably be an excess of the small balls over the large ones, and if only the latter are added as wear proceeds, the proper ratio cannot be maintained.

A number of curious observations with regard to wetted sand have been made by Osborne Reynolds (*Phil. Mag.* (5), 20, 469, 1885; *Scientific Papers*, 2, 217, 1901). If we have a rubber bag containing sand in the condition of maximum piling and add sufficient water to form a thin layer over the surface of the sand, squeezing the sand will cause it to expand or dilate and the water will be sucked down into the dilated mass. This experiment, in a different form, is no doubt familiar to all of us. The wet sand below the high watermark on the shore is in the condition of maximum piling; when we walk over this sand it whitens for a moment or so and appears dry round the foot. The sand is full of water, the surface of which is kept up to that of the sand by capillary attraction. The pressure of the foot dilates the sand, and as the water does not rise rapidly enough its level is lower in the dilated sand than before, and, therefore, the sand appears dry until the water has again risen by capillary attraction. When the foot is raised, the sand in and around the footprint usually becomes wet for a few seconds because, when the shearing force is removed, the sand contracts and an excess of water is left on its surface.

In a filter press the solid tends to assume the cubical piling since this condition allows the liquor to pass through more readily. If the crystals are displaced so that they pass into hexagonal piling, water will be set free. Thus, cakes of calcium sulphate which break with a clean fracture and appear quite dry may be reduced to an almost liquid mass by merely shaking. It would seem probable that in quicksands, the sand is in a state of cubical piling, thus making it possible for a body to sink into it and raise the water without raising the sand.

Some of the phenomena due to dilatancy are well illustrated by the following experiments carried out by Osborne Reynolds. He filled a thin transparent rubber bag with sand and water, and then closed it so that it contained no air. The amount of water was more than sufficient to fill the voids when the sand was at maximum density, but was insufficient to fill them when the sand was at the minimum density. Placed on a table, the elasticity of the rubber gave the bag a rounded shape, the sand settling into the condition of maximum piling with a result that a layer of water was present above the surface of the sand. As long as the level of the sand remains below that of the water the bag can be pressed and its shape altered, and it has no rigidity. If the bag is placed between two vertical surfaces and pressed, it changes its shape at first, without apparent resistance, but soon ceases to undergo deformation. If the bag is now laid on its side it will be found that a heavy weight, say 60 lb., may be laid on it without producing any further change in shape, but if the weight is removed the bag recovers its original rounded shape.

If, whilst being pressed between the vertical surfaces, the bag is shaken slightly, the sand persists in the condition of maximum density and the pressure may be applied until the bag becomes a broad flat plate. The bag remains soft as long as it is under pressure, but when the pressure is removed the elasticity of the rubber, by tending to pull the shape back to its original form, dilates the sand and results in the absorption of the excess of water, and once this has taken place no further change occurs and the bag remains a flat cake which possesses rather peculiar properties. It responds instantly to pressure on its sides, such pressure having only the elasticity of the bag itself to overcome as pressure in this direction causes the sand to contract. Radial pressure, however, finds the bag perfectly rigid because in this case the pressure tends still further to dilate the sand. Placed on its edge the bag will support a weight of 100 lb. If, whilst supporting such a weight, sufficient pressure is applied to the sides, all its rigidity is lost and the bag resumes its former rounded shape, and becomes once more a loose mass of sand and water. The bag can be made to take any shape by shaking it into a mould and then if the excess of water is removed and the bag closed, the sand becomes perfectly

rigid and will remain so until the bag is opened or torn. The sand is in a condition of maximum density and, therefore, no amount of shaking will effect any change. It is possible in this way to make bricks of sand or fine shot, &c., and water in thin waterproof envelopes which will withstand as much pressure as an ordinary brick without any alteration in shape.

The word plasticity is used in a special sense by clay workers to indicate a clay or material that is plastic and will burn to a coherent mass. Wet sand falls to pieces when dried and is not, therefore, plastic in the above sense. In order to meet this definition there must be present in the water some binding material, presumably in a gelatinous form. The thickness of the water films around clay particles is generally taken as about 50μ , and there is little difficulty in accounting for a gelatinous film. It has been shown that the cementing properties of powdered rocks is due to the formation of gelatinous silica, or ferric oxide, &c. (Cushman, *J. Am. Chem. Soc.* 25, 451, 1903). If there is a gelatinous film which is strongly adsorbed by the solid particles and which can take up and lose water, then plasticity will be exhibited. In the case of clay the gelatinous material may be hydrated silica or alumina, but it is difficult to explain why the clay remains plastic after moderate drying and readsorbs water. It is most likely due to the presence of some salt, what salt we do not know and we cannot, therefore, say why one clay is plastic and another is not.

From these considerations on the question of coalescence it may be concluded that liquid drops and solid grains will coalesce or agglomerate provided they are brought into actual intimate contact. To prevent coalescence there must be present on the drops or grains a surface film of some kind.

Coalescence occurs spontaneously and, therefore, work must be done on the solid or liquid in order to disintegrate it. It is easy to see that although a film may prevent liquid drops from coalescing it will not break up a large drop into smaller ones. Dirty mercury will remain indefinitely as a single liquid bulk, but if we do work on it by shaking it, a film will be formed over each drop and will then prevent the drops from coalescing when the shaking is stopped. Generally the film consists, in the case of mercury, of oxide, chloride or grease or an oxide of another metal. Any agent which will dissolve or remove the surface film will cause the drops to coalesce.

Emulsions of oil in water may be obtained if there is also present some substance, say a sodium salt of a fatty acid, which can produce a film over the drops of oil. It is clear that the work necessary to effect emulsification or pulverisation will be reduced in amount if something is added which reduces the surface tension of the liquid or solid. Water alone will cause disintegration in some cases, thus we get reversible disintegration with gelatine at very moderate temperatures, but a much higher temperature is required in the case of cellulose. It is not at all clear to what extent the structure of the material influences disintegration, but the following single illustration will serve to indicate the possibility of such a factor. If a crystal of rock-candy is placed in cold water it dissolves in such a manner that it preserves its shape approximately, it decreases in size but does not fall to pieces. If, however, a piece of lump sugar is placed in cold water, the smaller crystals, which act as a binding medium to the general bulk, dissolve first and the lump disintegrates into a mass of small grains.

Institution of Mining and Metallurgy

THE annual meeting of the Institution of Mining and Metallurgy was held at Burlington House, London, on April 20, Mr. S. J. Speare, the president, delivering his inaugural address. The chairman greatly regretted that the state of the mining industry did not yet permit the post-graduate scholarships and courses, which have been in suspense since the war, to be resumed. The membership of the institution has increased to nearly 2,500.

The Oil Palm and Plant-Breeding

The Importance of Scientific Selection

ONE of the most important and fascinating problems in connexion with oils and fats is that of increasing the yield from any given area by the practical application of plant research, or scientific selection and breeding. Enormous advances have been made in this vast realm of applied phytology in connexion with the ordinary fruits and vegetables of our gardens and orchards, as is well shown by examination of any up-to-date nurseryman's catalogue. The crops of the farm have also greatly benefited, for plant-breeding now occupies a prominent place in agricultural research, and valuable work is being done, for example, at Cambridge, by Professor Biffin and his colleagues, at Pusa in India, and at other places. Possibilities in this direction, indeed, are well-nigh incalculable. This is especially the case in that great division of the vegetable kingdom which comprises oleaginous plants, trees, and shrubs. The scope for advance here is all the greater in view of the fact that, hitherto, the greater part of our supplies of oils and fats have been obtained from those parts of the world in which agriculture is still carried on in the most primitive manner. It is a curious reflection that, in this twentieth century A.D. the great bulk of the supplies of a primary raw material of first importance in industry and commerce is still obtained by the very crude and primitive methods of the small native farmer who follows the same simple procedure of his forefathers, of hundreds, and perhaps thousands, of years ago. The soya bean of Manchuria, the sesame and linseed of India, the palm kernel of West Africa, the cotton-seed of Egypt, are for the most part supplied by the small native farmer, the ryot, the fellaheen, or others, as the case may be. Years pass, centuries unroll, and seed-time and harvest find ever the same old customs, the same old methods as of yore. Nothing changes. Leaving this highly poetical aspect of the subject we find, however, that large plantations on the European plan, backed with strong and sufficient capital resources, are on the increase in various parts of the world.

In particular the oil palm is being grown in large scientifically controlled plantations in Malaysia, the East Indies, and in West Africa. Much of the work, or rather, much of the published work, seems to have been undertaken by the Dutch and the French, and to some extent by the Germans in Togoland and the Cameroons. But doubtless the large English firms interested in the oil palm in West Africa have for many years engaged in this highly important and at the same time perfectly obvious line of research, for the advantages accruing therefrom are clear enough. And though their work and its results have been kept secret and closely guarded from the public eye, the lines along which such research is conducted can be fairly accurately laid down by anyone at all familiar with plant-breeding; for nearly similar methods must of necessity be employed to those used in other parts of the vegetable kingdom. In any case many years must elapse before results of any magnitude can accrue, owing to the fact, among others, that the oil palm must be at least five or six years old before it bears fruit; and the flowers and fruits of several generations of palms must be tested and compared before reliable data can be supplied or just inferences drawn.

West Africa has, until now, been justly regarded as the home of the oil palm, and although great attention is now being given to its cultivation in the East Indies, practically all the commercial supplies of palm oil and kernels are derived from Nigeria, Sierra Leone, Gold Coast, Belgian Congo, Dahomey, and other parts of West Africa, the total exports averaging about 130,000 tons of palm oil and 400,000 tons of kernels. At present the greater part of these exports are due to native culture or lack of culture, and the extent to which trade may be increased by the introduction of up-to-date scientific methods of cultivation and still more of oil-milling may be gauged from a recent statement of M. Antonetti, Governor of the Ivory Coast (French), that the output of palm oil from the Ivory Coast alone should ultimately reach 300,000 tons. The French, in fact, are now giving very close consideration to the question of research, especially botanical research or plant-breeding, in their African colonies, with special reference to improving the yields and quality of cotton, groundnuts, and palm oil.

This work is being carried out under the direction of the Institut Colonial de Marseille, whose able and enterprising director is M. Bohn, with the cordial collaboration of the

French colonial officials. Two research stations for oil palm study are to be organised, the largest and principal one being on the Ivory Coast, whilst a smaller one will be set up in Dahomey. The necessary arrangements are being made by M. Houard; a chemist has already been appointed for the Dahomey station, and a serious and earnest start is being made with the work this year. Another busy centre of study is at Bingerville, where M. Teissonnier, Director of Agriculture for the Ivory Coast, is in charge, and recently reported some interesting results of plantation experiments on the Dabou Plain. These experiments include artificial fertilisation, which simplifies the work of selection, and at the next harvest he proposes to make some notes on the growth, flowering, and other characteristics of selected palms. Some of the fruits already examined gave a yield of 73.6 per cent. pulp or pericarp, 53.3 per cent. oil from the pulp, and 40.8 per cent. oil from the whole fruit, and while there is nothing very remarkable about these figures, except that the percentage of pulp is well over the average, the yields are certainly good, even for Dahomey, where some of the best yielding West African oil palms are to be found. The main purpose of the research is to increase the yield of palm oil at the expense of palm kernel oil, for the palm oil can only be increased apparently by increasing the percentage of pulp or pericarp and reducing correspondingly the percentage of kernel and, therefore, of kernel oil. Early maturing and fruiting will, of course, be another object in view. Some of the young palms sown in January, 1918, and transplanted in June, 1919, produced male flowers indicating fruit-bearing capacity for 1922, that is to say, before the palm is five years old. This is certainly a step in the right direction if it can be maintained.

The difficulties in the way of clear and satisfactory nomenclature and classification of oil-palm varieties are fairly considerable, but without going into this purely botanical problem it may be said that the French experiments will chiefly centre around the *Pisifera* variety and the *Ceredia* (A. Chevalier), and attempts will be made to secure definite data for selection. It is proposed ultimately to lay out a large plantation of at least 400 hectares, sufficient to keep a small oil-mill going. Meantime two small plantations, one of two hectares for native instruction, and another of twelve hectares for European study, have been made, and samples of the soil from these have already been sent to France for examination, as the chemical laboratories for this and other work are not yet fully equipped. Two interesting questions arise in connexion with the evolution of a variety with little or no kernel, or of kernel in an atrophied form. One of these is the question of future propagation, and the other is the permanence or persistence of new and acquired characteristics. Neither of these questions can be satisfactorily answered in the present state of our knowledge, but they will, of course, have to be kept in view.

In making comparisons between oil-palm yields in West Africa and the East Indies it is necessary to remember that the latter have in most cases been carefully cultivated from selected seed, whilst the West African palm is for the most part grown wild or left to the superficial care and primitive methods of the native. The results obtained from some cultivated palms on an estate in Selangor (Federated Malay States) show what can be done with even a moderate amount of cultivation and care. Selected seed was imported from Sumatra in 1912 and sown in nurseries. The seedlings were planted out in May, 1913, and many of the trees bore fruit at three years and were in full bearing in their fifth year. The estimated yield per tree per annum is twelve bunches, each bunch weighing about 17½ lbs. This is much above the West African average, and many of the bunches weighed as much as 66 lbs., and a few weighed 136 lbs. The soil was of only average fertility and no manure was used. The planting of oil palms is being taken up on a large scale in other parts of the Malay States. A very considerable advantage in Malaysia is the early bearing of the palms: in some cases, as noted above, the bearing stage is reached in three years, as compared with five years in Africa and in the Dutch East Indies. This is a characteristic which the plant-breeder is always very keen about.

In the Dutch East Indies the chief centre of activity in oil-palm cultivation is the east coast of Sumatra, and although the trees do not come into bearing until the end of the fifth year the subsequent yields are very good and may more than compensate a later maturity.

The following tables give particulars of yields of bunches, fruits, kernels, &c., for the three localities, (a) Sumatra, (b) Java, and (c) West Africa:

TABLE I.
YIELD PER TREE PER YEAR IN LB.

Locality.	Year of Planting.	Year.	Number of Bunches.	Weight per Bunch.	Total Weight of Bunches.	Total Weight of Fruits.
<i>East Coast of Sumatra:</i>						
Mata Pao Plantation 1	1913	1918	12.1	6.6	80	31
		1919	9.2	10.8	199	40
" " " 2	1913	1918	—	—	—	—
		1919	9.5	12.1	115	51*
Poeloe Radja Plantation 1	1912	1918	11.3	14.0	158	51
		1919	14.5	14.7	213	46†
Poeloe Radja Plantation 2	1912	1918	—	—	—	—
		1919	12.6	16.5	208	53*
Bekalla Plantation	1898	1918	11.0	34.0	374	145
<i>Buitenzorg, Java:</i>						
Neglected plantation in Tjilendek Garden, 1916 and 1917 (Van Helten)	1876	1916 and 1917	2.3	41.8	96	48
<i>Africa:</i>						
Dahomey, Adam	—	—	10	13.2	132	55
" Chevalier	—	—	8	13.2	106	70
" Hubert	—	—	7	13.2	92	62
Guinea, Adam	—	—	5	13.2	66	44
" Chevalier	—	—	5	11	55	35
" Hubert	—	—	4	11	44	29
Ivory Coast, Chevalier	—	—	8	26.4	211	143
" Hubert	—	—	7	11	77	51
Senegal, Hubert	—	—	4	8.8	35	22
Average	—	—	6.4	13.4	91	57

* These trees were not so thoroughly pruned as those in group 1.

† The low yield of fruits in this group in 1919 was due to imperfect pollination.

TABLE II.
ESTIMATED NORMAL YIELD OF A PLANTATION PER TREE PER YEAR IN LB.

—	Number of bunches.	Weight per bunch.	Total weight of bunches.	Total weight of fruits.
5th to 10th year	12	13.2	158	53
11th to 30th year	10	33	330	165
31st to 50th year	3	44	132	66

TABLE III.
OIL CONTENT OF PULP AND KERNELS PER CENT.

Locality.	Age of trees.	Palm oil, per cent. of fresh pulp.		Palm kernel oil, per cent. of kernels.	
	Years.		Average		Average
<i>East Coast of Sumatra:</i>					
Mata Pao Plantation	5	32-44	36	55	55
Poeloe Radja Plantation	7	49-51	50	54	54
Marihat avenue trees	5	56-70	63	39-64	52
St. Cyr avenue trees	7-34	35-73	55	48-60	54
Bekalla trees	20-30	53-66	59	43-59	51
<i>Buitenzorg:</i>					
Neglected plantation in Tjilendek Garden 1916 and 1917 (Van Helten)	40	31-75	57.5	27-47	40
	—	23-66	53.4	36-59	40
<i>Africa:</i>					
Dahomey (Adam)	—	—	51	—	49
Guinea (Adam)	—	—	57	—	49
Average (Hubert)	—	—	55	—	50
Imperial Institute	—	50-77	58	43-50	47
Average	—	—	55	—	49

Without going fully into the strictly botanical part of the subject and the names and characteristics of the chief varieties (of which full particulars will be found in the *Kew Bulletin* for 1914, page 285 *et seq.*), a brief reference to the various factors which play a part in the well-being, cultivation, and commercial value or yields of the oil palm will be of interest.

Under climatic conditions we have to note first of all the elevation or height above sea-level at which the palms flourish. This varies from 3 ft. up to 3,000 ft., but it depends of course on latitude, aspect, and other factors. Palms in a wild state have been found in the Cameroons at 4,000 ft. and over. The mean annual temperature required is between 22° and 30°C., being about the same as that for cocoa; and the rainfall may be from 70 to 100 inches per annum, and should be spread over many months with frequent showers alternating with days of sunshine. A constantly saturated atmosphere is most favourable and the palms make most of their growth during the heavy rains. It has been found that the yield of oil is increased for two years after a season of high rainfall. Abundance of light is essential, and the trees must therefore be well spaced in the plantations, and the plantations kept perfectly clean. Inter-cropping with small plants is quite permissible and indeed advantageous. An interesting point here is that the black colour of the unripe fruit appears to be specially adapted for the absorption of heat-rays and sunlight.

The most suitable soil may be poor in lime and potash, but must be rich in nitrogen and humus. The trees bear earliest on alluvial soils, and give the largest fruit clusters and the most pulp on such soils, provided there is an absence of stagnant water and acidity. These essential soil conditions appear to be found in a particularly marked degree on the east coast of Sumatra and in certain parts of West Africa.

Climate and soil are natural conditions which cannot be fundamentally altered by the scientific plant-breeder, and he must, therefore, choose his locality with the utmost care, and all his data and results must be specifically referred to these conditions. Given these, however, there are several other factors comprising the more artificial side of plant culture which must have a profound bearing on results. These include methods of propagation, selection of seed, preparation of seed beds, transplanting, pruning, manuring, inter-cropping, pest and disease control, and correct harvesting.

The oil palm can only be propagated from seed, and great care must be taken in the selection of seed owing to the very great differences of yield. To secure regular germination it is advisable to ferment the fruits for some days in a sack or box before sowing; and if they are to be transported to a distance it will probably be best to depulp the fruit without the use of heat, dry the nuts, and pack them in charcoal. The seed will obviously be selected from trees giving the best yields and which will have been marked out for the purpose. In order to determine as quickly as possible the increase in productivity it is well that daughter trees should be planted from numbered mother trees of high and low productivity; and if, after some years it is actually found, as is very probable, that the oil palms in daughter plantations raised from mother trees of high productivity give greatly improved yields, it will be possible to increase the production considerably by continuous selection in this way. The best variety to aim at will be one that comes into and remains in bearing when low enough to be easily harvested, will ripen its cones simultaneously, and yield large fruits with thick pulp rich in oil, thin shell, and heavy kernel; although this does not appear to be quite the same ideal as that which Teissonnier has in view for French West Africa. It will depend partly on the future course of trade, and the respective world demands for palm oil and palm kernel oil.

The most important experimental work in seed-sowing has been undertaken in the Dutch East Indies, in Sumatra, where several different methods have been tried, including those at the Botanical Gardens of Buitenzorg. The optimum conditions are: immerse the seeds in warm water or otherwise heat them, plant them about 8 in. apart each way, flat side downwards, and do not shade the beds, as a high temperature, up to 122°F., is desirable. In West Africa the seeds germinate in five or six weeks, but in Sumatra they require six to nine months, and this, of course, must be taken into account in connexion with early maturity.

There is not space to describe all the work in the direction of transplanting, pruning, manuring, &c., nor the various pests and diseases and their treatment; but it is necessary to note in regard to the figures given in the tables for Sumatra that these refer to groups of numbered trees of ten to twenty per group. Once or twice a month the officers of the Experimental Station

collected and weighed the ripe fruits from each tree. The whole of the product was thus removed, bunch by bunch, and the weight of the stalks, fruits, pulp, nuts and kernels determined. In the case of some groups these observations were made for a whole year and in others for single months. The results generally show that the oil palms on the east coast of Sumatra give a high yield of pulp (62 per cent.) and a low yield of kernels (8 per cent.), and thus the trees appear to be gradually evolving the ideal contemplated by Teissonier for French West Africa.

Decolorising Palm Oil

Rancidity and Unsaturated Glycerides

At the April meeting of the Manchester College of Technology Evening Students' Chemical Society Mr. John Allan dealt with some points in connexion with oils and fats. The lecturer first dealt with the colouring matter of palm oil. Oil and colouring matter frequently existed together in the oil-bearing seed or fruit, and during the extraction of the oil the colouring matter was also removed. This occurred in the case of palm oil. In addition to such natural colouring matters, which were frequently fairly easy to remove or destroy, coloured substances were formed during the processes required in the manufacture of the oil, and these were more resistant to ordinary bleaching operations. In some cases the colouring matter could be removed by absorption or adsorption, and in others by bleaching to a colourless compound which remained in the oil. The precise method adopted depended on the use to which the oil would subsequently be put, but in all cases the process used must be without action on the oil itself. Palm oil, the extraction of which varied in detail in different localities, was, roughly speaking, the same throughout the Tropics, and possessed both a colour and an odour.

Empirical Methods

The oil-containing palm fruit contained a large amount of fibre and the pulp was very easily bruised. In the tropical localities to which it was indigenous it was very susceptible to enzymic fermentation, and hence palm oil usually contained at least 10 per cent. of free fatty acids. In some cases as much as 80 to 90 per cent. free fatty acids were present. Mr. Allan stated that he had examined samples which contained no glycerides, the whole being free fatty acids. More or less empirical methods were generally used for bleaching this material, but the importance of the process, particularly in connexion with the manufacture of edible fats, was so obvious, and made the isolation of the colouring matter and the examination of its fundamental properties practically a necessity. By a process of fractional crystallisation from the unsaponifiable matter it was obtained in an orange-brown crystalline substance melting at 170°-172°C. It was sparingly soluble in alcohol and ether, but readily so in acetone. It was very susceptible to oxidation. Even exposure to the air was sufficient, as was the case with carotin, and a very powerful violet odour was possessed by the product of oxidation. The chromophorous group evidently possessed the unsaturated ethylenic double linkage, and consequently could only be bleached by saturating the double bond. From this it could be seen why sulphur dioxide was ineffective to bleach palm oil, but nascent hydrogen was effective, and also why hydrogenation also decolorised the oil. The double bond could also be saturated by oxidation, hence the common method of bleaching by exposing thin streams to air or the use of a bichromate and an acid. Oxidation bleaches, however, always led to the development of a violet-like odour; reduction bleached oils did not exhibit this odour. The importance of this in connexion with edible oils was obvious.

Fat Soluble Vitamines

The lecturer then dealt with "Fat Soluble Vitamine A," which he said had been found to occur to a greater extent in the more highly-coloured fats of the same species. In the case of beef fat, that which was yellowest contained a higher percentage of fat soluble A than the paler coloured fat. The relationship was carried further; milk from an animal which gave the yellowest fat contained more fat soluble A than milk from one yielding a paler fat. It was also found that animals fed on green food gave higher-coloured fats and milk than stall fed animals which produced fats and milk with a low vitamin content.

Turning to another point the lecturer stated that until recently it was accepted that the rancidity of oils and fats was due to oxidation changes of the free fatty acids which were present even in the highest-grade fats. It had, however, been shown recently that it was possible for a fat to have large amounts of free fatty acids and yet keep without the development of rancidity. Mr. Allan was of the opinion that we really knew very little about the nature of rancidity, and rancidity is frequently confused with other disagreeable flavours which developed in the fat and had nothing to do with true rancidity. We did know, however, that rancidity was usually associated with an increase in free fatty acids, though recent work seemed to indicate that rancidity came first and fatty acids afterwards, and not that fatty acids came first and rancidity afterwards.

Theories of Rancidity

Kerr believed that rancidity was due to oxidation of unsaturated glycerides, and hence, given a fat whose iodine number was zero, rancidity would be impossible. He had shown that fats freed from oxygen and kept out of contact of oxygen or air will keep for years without showing signs of rancidity. In absence of air even exposure to ultra-violet light does not induce rancidity. In connexion with the unsaturated glycerides it had been pointed out that if an oil were bleached with a powerful oxidising agent the oxygen compounds formed by the entrance of oxygen into the double bond apparently acted as oxygen carriers. This indicated the importance of careful treatment of oils in the earlier stages of manufacture, particularly if they were to be subsequently stored or treated for the preparation of foodstuffs. The tendency to rancidity in fats might frequently be due to lack of care in the earlier stages of manipulation. As an instance of this it might be mentioned that it had been shown that treatment with some of the bleaching earths known as "fuller's earth," particularly those of American origin, was actually provocative of rancidity, whereas oils treated with other very similar earths kept perfectly. The point of view that rancidity was a factor of the unsaturated glycerides was one which deserved careful consideration.

The lecturer then dealt with the yield of oil obtained from the plant, and said that the tendency was to accept whatever Nature gave us without comment. In the case of sugar beet, however, it was only selective cultivation which brought up the yield of sugar in the juice from 4 to 6 per cent. to 16 to 18 per cent., and made it such a serious competitor of the sugar cane. Oils, however, were in a rather different category, the possible increase in yield being smaller. An oil-bearing plant which yielded less than 10 per cent. was not regarded as a commercial possibility unless the oil was exceptionally valuable. Nevertheless attempts had been made to cultivate cotton with a view to increasing the oil yield, and, to quote from a report, strains had been grown which produced varying percentages of oil, both high and low; where the oil content had been increased the cotton content had been decreased and the increase in the yield of the oil was not sufficient to affect the loss of the cotton content. The lecturer was of the opinion that this was a question of plant metabolism. Since both cotton and oil contained the same elements it was possible that the plant was only capable of producing a certain total which was distributed between cotton and oil. It had been noted that wherever the oil content was increased the size of the seed was also increased.

In answer to questions the lecturer stated that the personal element was often responsible for the verdict as to whether a fat was rancid or not. Some measure of rancidity, however, could be obtained by determining the presence of aldehydic substances, for instance by the phloroglucin reaction. Bacterial action and the growth of moulds might produce flavours which were confusable with rancidity, but absolutely sterile fats would go rancid. Fats which contained albumenoids usually contained larger traces of water than nitrogen free fats, a condition more favourable for the growth and development of bacteria and moulds.

Allessandro Volta's Correspondence.

THE librarian of the R. Istituto Lombardo di Scienze e Lettere of Milan is anxious to find letters and manuscripts written by Allessandro Volta, for a national edition of Volta's works which is being prepared under the auspices of the Italian Government. Information on the subject should be sent to Mr. Paget Toynbee, Fiveways, Burnham, Bucks.

British Chemical Trade in India

Opportunities for Development

The following particulars are taken from a general review of the conditions and prospects of British trade in India during the fiscal years 1919-20 and 1920-21, revised to October, 1921, by Mr. T. M. Ainscough, H.M. Senior Trade Commissioner in India and Ceylon (Department of Overseas Trade, pp. 362, 58.).

Indigo

The area under this crop fell from 292,000 acres in 1918-19 to 246,500 acres in 1919-20, and the estimated total yield of dye from 48,600 cwt. to 42,600 cwt. The quantity exported amounted to 32,700 cwt. The average yield of dye per acre showed a slight increase. During the year, an organisation, styled the Indian Indigo Co-operative Association, was established in Calcutta in order to promote by co-operative methods the sale of indigo and to assist further research and propaganda.

Oil Seeds

The area under the various oil-seeds—linseed, rape, mustard, sesamum and groundnut—rose from 11,873,000 acres in 1918-19 to 14,835,000 acres in 1919-20, and the yield from 1,907,000 tons to 2,887,300 tons. The total quantity of oil-seeds exported during the year was 825,000 tons, valued at Rs. 26.27 lakhs. In addition to this the exports of copra amounted to 10,600 tons as against 450 tons in 1918-19.

India is one of the largest of the world's sources of supply of oil-seeds. The output of the raw product was until recently far short of the world's demands, and the high prices acted as an incentive to increased production of the various kinds. The work of the Agricultural Department is mainly in selection and varietal tests.

Petroleum

A return of the quantity and value of petroleum produced in India during 1918 and 1919 shows an increase of about 19 million gallons, the total production being 305,651,816 gallons. The chief increases were over 32½ million gallons from the Singu field, over ½ million from the Upper Chindwin field, both in Burma, and 1 million from the Badarpur field in Assam. The Yenangyaung field was responsible for the principal decrease in production, its output having fallen by about 13½ million gallons. There were also reductions in the outputs of Yenangyat, Minbu, Digboi, and Attock. Notwithstanding the fact that India produced within her borders nearly 306 million gallons of petroleum, the imports of mineral oils were enormous and aggregated, in 1918-19, over 60 million gallons, and in 1919-20 over 144 million gallons. The exports of paraffin wax from India continued to expand, the total quantities shipped being 532,479 cwts., valued at £1,216,252. The principal destinations were the United Kingdom, Japan, and Australia.

Salt

There was an increase of two million tons in the output of salt in India during 1919, the total production being 1,891,138 tons, valued at £1,823,522. The principal producing areas are Bombay, Madras, Northern India, and Aden. At the same time, 481,700 tons were imported, principally from Egypt and Aden, to satisfy the demands of Bengal and Burma.

Manganese

The output of manganese ore amounted to 538,000 tons in the year under review, and of this 370,000 tons, valued at £697,732, were exported, mainly to the United Kingdom. More than 80 per cent. of the production came from the Central Provinces, with smaller quantities from Mysore, Orissa, and the Bombay Presidency.

Mica

The quantity of mica produced was 45,783 cwt., valued at £219,842, and showed a decrease of nearly 9,000 cwt.

Monazite

There was a slight decrease in the output of monazite in Travancore, which fell from 2,117 tons, valued at £58,819, in 1918 to 2,024 tons, valued at £60,712, in the year under review.

Tungsten

There was a marked decrease in the output of wolfram, which fell from 4,431 tons in 1918 to 3,577 tons in 1919. As usual, most of the output came from Tavoy in Burma. The industry is still extremely depressed and many of the Tavoy mines have shut down.

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Saltpetre

There was a decided fall in the production of saltpetre, due chiefly to a decrease of 41 per cent. in the production of the United Provinces. The total Indian production amounted to 17,550 tons, valued at £471,247. The principal sources of supply are the United Provinces, Bihar, and the Punjab. Practically the whole of the saltpetre produced is exported, the principal markets being the United Kingdom, the United States, Mauritius, Japan, and Ceylon.

Bauxite

The output of bauxite amounted to 1,682 tons, valued at £1,934. The whole output came from Jubbulpore. Important bauxite deposits have recently been discovered by Mr. C. S. Middlemiss in the neighbourhood of Chakar, in the province of Jammu. The quantity available by quarrying at the surface has been estimated at over one million tons, the beds extending uninterruptedly for many miles. Patches of the same material were also observed by Sir Henry Hayden at Sagar. Analyses of these specimens yielded 79.43, 67.03, and 59.56 per cent. of Al_2O_3 and 1.32, 14.75, and 20.67 per cent. of SiO_2 respectively.

Corundum

The output of corundum amounted to 14,131 cwts. in 1919, scarcely more than a third of the production in 1918. Of this, almost the whole was mined in the Khasi and Jaintia Hills of Assam and a small quantity in the Rewah State in Central India.

Other minerals such as asbestos, gypsum, graphite, ochre, molybdenite, steatite, &c., were only produced in such small quantities that they do not call for special mention.

British Chemical Plant

Nothing has so far been published with regard to some of the most important work of the Institute of Science, Bangalore, as it has been experienced that such publication merely results in a host of imitators of the process. Papers, however, are now being prepared on sandalwood oil and caffeine which will be published shortly. The Institute might be of service to British manufacturers in introducing their plant into India. It has been found that certain British chemical plant, even by well-known makers, is so badly designed for Indian conditions and the price is so high that efforts are now made to get as much as possible constructed locally. The Institute are in a position to, and in fact do, advise the purchase of certain machinery, and their experience has been that, with a few notable exceptions, British plant is frequently insecurely packed, and no instructions are given for assembling the broken fragments. They have never obtained the least practical information from firms who advertise research laboratories, and offer to design plant, where anything slightly out of the ordinary is required. The greatest handicap which they experience, however, is the refusal of most firms to supply price lists. A great deal of the work of the Institute consists in drawing up tentative rough estimates. For this purpose some idea must be obtained of the cost of the plant so that a decision may be arrived at on the merits of one type of plant as compared with another. The only course possible at present is to draw up a more or less complete scheme for each type of plant and write for estimates. This gives home makers a good deal of trouble, especially as the Institute are not likely to place an order for the plant for a year or two and in most cases not at all. If approximate prices for a few typical pieces of plant could be obtained, this would suffice, but requests for such information are met with the reply that the exact specification should be given. Catalogues are carefully collected at the Institute, but most of them are of little value in the absence of prices. I mention all these facts in detail, as I understand that experience with American firms in these matters has been far more satisfactory. I would strongly urge British makers of research laboratory equipment and plant for chemical processes to place themselves in direct touch with the Director, Indian Institute of Science, Bangalore, South India.

Drugs Manufacture Committee

Although much remains to be done before the resources of India are fully utilised in the production of drugs, the following list of articles of which Government requirements are wholly or in part derived from Indian sources shows that some progress has been made. Many of these have been made in India only since the beginning of the war, and many are prepared in the factories of Government Medical Store Depots.

Absolute alcohol.	Pharmaceutical preparations
Acids (hydrochloric, nitric and sulphuric).	of aloes, asafoetida, belladonna, benzoin, cinchona, colocynth, digitalis, hyoscyamus, Indian hemp, liquorice, nux vomica, opium and squills.
Alum.	Plaster of Paris.
Ammonia.	Potassium carbonate.
Argenti nitras.	Prepared chalk.
Caffeine.	Pyroxylin.
Calcium carbonate.	Rectified spirit.
" chloride.	Soft soap.
" phosphate.	Sodium arsenite.
Castor oil.	" carbonate.
Collodion.	" chloride, chemically pure.
French chalk.	" nitrate.
Glucose.	" phosphate.
Keratine solution.	" sulphate.
Lysol.	Starch.
Magnesium carbonate.	Sulphate of iron.
" sulphate.	Talc.
Morphia.	Tannic acid.
Oleic acid.	Thymol.
Oils of aniseed, dill, cloves, caraway, cedarwood, chaulmoogra, croton, sandalwood, theobroma, eucalyptus and turpentine.	

Chemicals and Chemical Preparations

The offtake of chemicals and chemical preparations (excluding chemical manures and medicines) has recently averaged just over two millions sterling per annum. The total imports are as follows:—

1918-19.	1919-20.	1920-21.
£1,661,710	£1,610,503	£2,661,346

It is most satisfactory to remark that the United Kingdom has regained the pre-eminent position she occupied before the war, as the following table clearly indicates:—

Percentage Share of Principal Countries in the Total Value of Chemicals Imported.

	1913 to 1914 (pre-war)	1914 to 1915	1915 to 1916	1916 to 1917	1917 to 1918	1918 to 1919	1919 to 1920
United Kingdom	74.7	81.6	82.2	69.5	67.2	63.2	75.8
Japan	1.5	2.2	6.5	17.2	20.4	24.3	11.9
Italy	5.2	5.2	4.6	5.6	0.3	1.2	2.0
United States	0.3	1.6	2.9	4.5	10.7	5.7	6.6
Germany	12.4	5.4	0.7	—	—	—	—
Other Countries	5.9	4.0	3.1	3.2	1.4	5.6	3.7
Total	100	100	100	100	100	100	100

Were the detailed figures for 1920-21 available, there is little doubt but that they would show a still further improvement in the British position. It will be observed that Japan has temporarily taken the place formerly occupied by Germany and that the competition from the United States is growing. It may be of interest to examine the principal items separately.

Acids.—Total imports 1919-20, £86,521, 1920-21, £146,157. The principal item is tartaric acid, of which the United Kingdom supplies 70 per cent. and the balance is drawn from Italy and France. Practically all the nitric, sulphuric, and carbolic acid is obtained from Great Britain. The imports of sulphuric acid have tended to decline owing to the increased manufacture in the country from sulphur imported from Sicily and Japan. In my last report I mentioned the proposed erection of a plant by the Burma Mines Co., Ltd., at Jamshedpur, for the manufacture of sulphuric acid in connexion with their scheme for the production of spelter from their

Burma zinc concentrates. It may not be out of place here to state that I understand this scheme is being abandoned after very large sums have been spent on the site.

Bleaching Materials.—These consist almost entirely of bleaching powder, which during the war was mainly imported from Japan. The United Kingdom now supplies £105,000 out of a total of £133,000, or roughly 80 per cent., imports from Japan having fallen to 10 per cent. and those from America representing a further 10 per cent.

Sodium Compounds.—Nearly 50 per cent. consist of sodium carbonate (soda ash and soda crystals) for bleaching, dyeing soap, glass and papermaking, &c. The United Kingdom has the virtual monopoly of this trade, thanks to the enterprise of one of the largest British companies, who have an admirable sales organisation throughout the market. The imports in 1920-21 were valued at £411,910.

Sulphur.—The imports were £157,532 in 1919-20 and £224,893 in 1920-21. The article is largely used for the manufacture of sulphuric acid and the imports are obtained, 80 per cent. from Japan and 13 per cent. from Italy.

Potassium Compounds.—Total imports in 1919-20, £31,357, 1921-21, £75,074. The United Kingdom supplies approximately 50 per cent., the balance being fairly evenly divided between Japan, Italy, and Sweden.

Disinfectants.—India is an important market for disinfectants, and the trade is strongly held by the United Kingdom. The small trade in naphthalene disinfectants (£9,000 in 1919-20) is fairly equally divided between the United Kingdom and Japan, but in the ordinary kinds, valued at £67,000, the British share was £66,000. The leading Home brands are well-known and actively sold.

Dyeing and Tanning Substances

Of these by far the most important are dyes obtained from coal tar. The position is as follows:—

Origin.	1919-20.		1920-21.	
	lb. (1,000)	£	lb. (1,000)	£
United Kingdom	3,552	534,648	3,467	940,268
Germany	90	8,007	3,653	1,169,670
Belgium	41	15,169	392	133,065
Switzerland	516	275,369	318	150,610
United States	1,918	546,449	2,013	758,552
Other countries	8	4,663	787	213,904
Total Imports	6,125	1,384,305	10,630	3,366,069

Of these, aniline dyes are the most important—in fact, India is the largest overseas market for anilines and is also the most important outlet for alizarines. The imports of each are as follow:—

Description.	1919-20.		1920-21.	
	lb. (1,000)	£	lb. (1,000)	£
Alizarine dyes.	2,027	220,740	3,883	732,368
Aniline dyes	4,098	1,163,565	6,738	2,631,033
Others	—	—	9	2,668
Total	6,125	1,384,305	10,630	3,366,069

Alizarine Dyes.—Notwithstanding the considerable increases in the past two years, the imports are still well below the pre-war volume. In 1913-14, 6,469,739 lb. were imported, of which Germany supplied 4,637,450 lb., the United Kingdom 963,698 lb., and Belgium (mostly of German origin) 804,243 lb. In 1919-20 the United Kingdom supplied 1,932,372 lb. and Germany 89,600, but last year, for the first time since the war, German importations have exceeded the British. This, of course, is largely due to the depreciated mark, which enables the German dyes to be placed on the Indian market at exceedingly low rupee prices. The leading British works have recently been extended, they have an active selling organisation in India, and they are confident that—excluding wholly fortuitous circumstances such as the low German exchange—they can meet German competition in respect of cost of production and selling organisation. It will be interesting to follow the course of events during the next few years.

Competition will be keener than ever before, but it is hoped that the British manufacturers will manage to retain a large share of the trade.

Aniline Dyes.—The progress made by the leading British makers is noteworthy and they are rapidly strengthening their position, but the entry of German dyes in large quantities during the past twelve months has created a very difficult situation. Although this competition could be met in normal circumstances, the depreciated value of the mark enables our rivals to make extraordinary low rupee quotations. The German producers are re-appointing agents throughout India, and are endeavouring to revive their pre-war organisation with the one qualification that they are not permitted by legislation to reside in the country for some years, and so are obliged to leave their interests in the hands of Indians and others. Meanwhile the largest British company has established a main depôt, with laboratories, repacking works, &c., at Bombay, and employs its own staff of technical and commercial men. Sub-depôts have already been opened or are about to be opened in the leading consuming centres, and every endeavour is being made to cater for the demands both of the mill and bazaar trades. Other British manufacturers are employing the services of merchant agents, and there appears to be no doubt that a determined fight will be made for the trade. Competition is being encountered not only from Germany, but also from the United States and Switzerland. The American houses are particularly active, and usually distribute their goods through Indian selling agents. It is somewhat strange that the average value of American dyes imported should be higher than the British—Rs. 3.76 per lb. as compared with Rs. 2.71 per lb. Hopes had been entertained that India might have followed the example of the United Kingdom in prohibiting the import of dyes except under licence, but Indian consumers are anxious to have the widest possible market for their dyestuffs, which they regard as a raw material of the growing textile industries, and moreover they are not generally disposed to interfere with imports from Germany in view of the fact that Germany is normally one of the largest consumers of India's exports.

Soap

The soap trade, thanks to the enterprise of the two largest soap-producing companies in the United Kingdom, has hitherto always been almost exclusively in British hands, and it is satisfactory to note that the trade is not only increasing, but that British imports represent each year an even greater proportion of the total.

Origin.	1918-19.	1919-20.	1920-21.
	£	£	£
United Kingdom	612,968	1,082,351	1,309,847
Other countries	54,456	139,962	99,617
Total Imports	667,424	1,222,313	1,409,464

In my last report, I dealt at some length with the competition of Indian-made soaps for household use. The remarks then made still hold good, and I believe that this is the only serious competition which we may meet in the future. Should this competition ever become really serious, owing to protective duties or other causes, then the only way to counter it would be for British manufacturers to erect works in the country.

Paints and Painters' Materials

There is a considerable and growing trade in paints and colours. The position is as follows:—

Origin.	1918-19.	1919-20.	1920-21.
	£	£	£
United Kingdom	258,736	735,260	1,263,639
Japan	327,850	79,072	23,084
United States	135,637	87,399	139,491
Other countries	23,676	65,096	98,485
Total Imports	745,899	966,827	1,524,699

It is gratifying to observe that the United Kingdom has regained her position in the trade. American competition is becoming insistent, particularly in white lead and in the high-grade paints such as those manufactured by the Paraffin Paint Co. of San Francisco and sold under the style of "Pabco." Japanese competition, however, is likely to decline and was merely a war growth. The heading "Other Countries" mainly covers imports from Hong Kong.

Painters' Materials.—These comprise:—

Description.	1918-19.	1919-20.	1920-21.
	£	£	£
Genuine Turpentine	21,490	42,345	60,344
Reduced Turpentine		9,758	8,305
Varnish	78,040	228,565	307,005
Other kinds		59,641	51,812
Total	99,530	340,309	427,466

In 1919-20 the United Kingdom supplied 71 per cent. of the genuine turpentine, 87 per cent. of the reduced turpentine and 87 per cent. of all varnishes. The only serious competition was that from the United States, which furnished 26 per cent. of the genuine turpentine and 12 per cent. of the varnish. The most serious future competition is likely to be that of Indian paint and varnish works. Turpentine is already being made in the country in increasing quantities. Indian products include all that is necessary for the vehicles of ordinary paints, while mineral resources and established manufactures provide all the pigments necessary for some few paints and a large proportion of the pigments in other cases. The few paint works in operation in India are successful concerns.

Drugs and Medicines (excluding Chemicals and Narcotics)

The trade is a valuable one and has recently increased considerably, as will be seen from the following table:

Description.	1918-19.	1919-20.	1920-21.
	£	£	£
Camphor	115,068	246,503	267,749
Cassia Lignea	84,806	165,186	128,639
Cinchona bark	96	147	252
Morphia and preparations of Opium and Morphia	—	4,196	6,950
Proprietary and Patent Medicines	163,376	304,880	281,177
Quinine Salts	155,088	233,227	354,186
Other sorts	459,528	870,825	1,073,876
Total	977,962	1,824,964	2,112,829

Seventy-two per cent. of the camphor comes from Japan (or rather Formosa). Severe competition is met with in the trade in quinine salts (of which quinine sulphate or bisulphate is the most important). Java supplies 45 per cent., the United Kingdom 40 per cent., America 6 per cent., and Japan 6 per cent. In proprietary and patent medicines, competition is becoming very keen, and both America and Japan have made great progress during the war. The United Kingdom still provides 56 per cent. of the imports, but the American share is now 24 per cent., that of Japan 8 per cent., and France 7 per cent. The general drug trade is also becoming much more competitive. The share of the United Kingdom in "drugs, other sorts," is 55 per cent., America 16 per cent., Japan 7 per cent., and France 3 per cent. The balance is made up by the import of native drugs from sources such as the Straits, Hong Kong, and Portuguese East Africa. In high-grade preparations the United States is becoming a keen rival, while Japan is strengthening her hold on the cheaper drugs and patent medicines. Of the total imports in 1919-20, the United Kingdom supplied 42 per cent., the United States 12 per cent., Japan 12 per cent., Java 6 per cent., France 3 per cent. The remainder was obtained from Hong Kong, Persian Gulf, and other Eastern sources and was non-competitive.

Political Finance: Its Devastating Effects on Trade

By Sir Ernest Benn

THE interest for the business man in the Genoa Conference is not in the way in which the various delegates are manoeuvring for position or in the extraordinary rapidity with which the political kaleidoscope revolves and changes, but rather in the emergence of the long-delayed hope that an economic sense, a return to financial sanity, seems at last to be in prospect.

It will, indeed, be a strange if a fitting conclusion to the mixture of drama and comedy which goes to make up the history of Europe in the last few years, if the Bolsheviks should for a time occupy the centre of the stage and complete their mission, giving to the world one brief, great, and awful demonstration of the utter futility of what may be described as "political finance." These madmen, at the frightful cost of millions of their own people, have completed the exposure of the idiocy of communism. They are now giving a practical demonstration of the impossibility of the economic war.

The Genoa Conference is assembled to discuss economic questions and to debate once again how much money certain countries shall pay, and how much others shall receive—a discussion the absurdity and impracticability of which I have never ceased to argue. Trade, industry, and commerce cannot again resume the full measure of their service to mankind until the politicians cease meddling with the medium of exchange. So long as political conferences continue to discuss the allocation of large sums of money between different nations, so long will money fail to exercise its proper functions, and so long will trade and commerce remain almost an impossibility.

The difficulty is that politicians, like, indeed, most human beings, have the flimsiest conception of the character of this thing called money about which they talk so glibly and decide so lightly. If the Prime Ministers of Europe were to collect all the violins in existence and distribute them among professors of mathematics, they might satisfy a crude sense of justice, but they would get no music. Similarly when they attempt to settle political problems through the medium of exchange, they merely rob money of its power for good. Money is a medium of exchange which was created and perfected by commercial men for the purposes of commerce; it has no real use except in connexion with the exchange of commodities; it ceases to be money when it fails to represent realities. The trouble is that the machinery of finance has been brought to such a pitch of scientific perfection that it is possible for people for whose use it was never intended, like gamblers or politicians, to get hold of it and use it for purposes for which it is utterly unsuitable; and the worst of it is that in so using it the politicians or gamblers cannot avoid the exercise of a very damaging influence upon all those who are concerned in the use of money for its proper and legitimate purposes.

We are gradually learning our lesson; the next generation will accept as an article of faith the unalterable truth which this generation is not yet quite able to see—that the divorce of money from exchange is a crime, and the worst form of crime, inasmuch as it damages not only those immediately concerned in its perpetration, but every human being in existence at the time that it is done. There is no difference between some of the decisions of the allied conference in the realm of finance and Kruger's historic demand for moral and intellectual damage. The true import of Kruger's innovation was not realised at the time because he was dealing in very small figures, but when the Bolsheviks put forward a claim for £1,500,000,000, the essential fallacy of the whole business becomes apparent.

The business man, who as a business man is not in the least concerned with the political manoeuvres at Genoa, can see these things a little more clearly than the general public; for instance, if it is right and proper that Czecho-Slovakia, which may without offence be described as the Ireland of Austria, should receive financial consideration in respect of the part which it played in the war, there can surely be no objection to interpreting in terms of money the service rendered in the same cause by the Russian steam-roller. The truth is, of course, that neither case can be settled on a cash basis. The absurd results which have already accrued from this attempt to assess war claims in the medium of exchange are demonstrated for the benefit of all who care to study the matter in the present price of money in Central Europe. I journeyed through six countries a few weeks ago, and changed

sovereigns for 48 francs in France, 55 francs in Belgium, and 850 marks in Germany, but the gross stupidity of it all is illustrated still better by the position of the old Austrian crown. The same crown, which a few years ago was worth roughly 1s., stood in Austria proper at 32,000, in Hungary at 3,500, and in Czecho-Slovakia at 320. The difference between 32,000 and 320 was not even a difference of form; the same piece of paper serves for both crowns. The mere addition of a red ink stamping impressed to the order of the politicians makes one paper chit worth 320 and the other worth 32,000.

If the traveller will board the Ostend-Constantinople express which now runs daily, he can drink cups of coffee out of the same pot, or eat slices of meat off the same joint without even changing his seat, and pay nine or ten different prices for the same article, the price being regulated by the country into which the train happens to have wandered. I know of no illustration which more graphically exposes the impossibility of the situation.

The Germans and the Bolsheviks may have been guilty of treachery; they may be devoid of all sense of honour in negotiation; they may be unworthy to sit at the same conference table with more orthodox diplomats. These are questions of which I am no judge, but in deciding, as they appear to have done, to wipe out between themselves all indemnities, all reparations, and all sums of money which do not represent exchange for value given, they have set an example which sooner or later the rest of us, although we may not yet have reached a state of mind in which we are prepared to realise it, will be bound to follow.

We are now nearer than ever to the happy day when money and finance will be understood as the special province of the business man; when the world will understand that war has nothing to do with business, and that the machinery of business cannot be made to clear up the messes of war. The two things are as wide apart as the poles. When we have learnt that lesson, and it seems as if we are now beginning to do so, trade, commerce, industry, and all that makes for civilisation, will once more resume their beneficent service to mankind.

New Dyeing Process

Important Discovery at a Manchester Laboratory

SOME results of researches on the dyeing of the acetyl silk made at the Spondon works of the British Cellulose and Chemical Manufacturing Co., Ltd., were given before the West Riding Section of the Society of Dyers and Colourists in October last, by Mr. J. F. Briggs of the British Cellulose Co. (see THE CHEMICAL AGE, Vol. V., p. 527). As the result of investigations in the research laboratories of the British Dyestuffs Corporation, Ltd., at Blackley, Manchester, Professor A. G. Green, who has made a special study of the dyeing of acetyl silk claims to have discovered an entirely new class of dyestuffs called "ionamines," which he describes as a development of the dyestuff "Primuline," which he discovered thirty-five years ago.

"Ionamines," according to Professor Green, will only dye silk, either real or artificial, but upon these materials they produce a considerable variety of shades. Very interesting experiments have been worked out by taking one of these new dyestuffs and mixing it in a bath with another dyestuff having a direct affinity for cotton, as, for instance, chlorazol blue, and dyeing from this bath a mixed material of cotton and artificial silk, such as a cotton fabric containing silk "effect" threads. On the removal of the material each fibre will be observed to have selected its appropriate dye, the cotton becoming blue and the silk yellow, orange, or red, according to the particular "ionamine" used. Professor Green is convinced that there are almost infinite variations to this process, because most dyestuffs which have a direct affinity for cotton have little or none for "acetyl" silk, whilst the reverse is true for the "ionamines." He is also of the opinion that the matter does not even stop here, for by a suitable choice of cotton dyestuffs and "ionamines" it is possible to produce by subsequent chemical changes on the fibre a still greater range of shades, and at the same time to increase their fastness.

It has been pointed out that the production of two colours at once is not altogether new, for according to Pliny, the Egyptians were able to obtain two colours out of one dye-bath by changing the mordant. The effect was that the same fabric was treated with two different mordants, whereas in the new process there are two different textiles, each taking a separate colour.

British Cellulose Co.'s Losses

Proposed Reorganisation of Capital

A SCHEME for the reorganisation of the British Cellulose and Chemical Manufacturing Co., Ltd., provides for a reduction in capital from £7,750,000 to £6,000,000, and for the provision of new capital to the extent of £336,800. According to this plan the ordinary shares will be written down from £1 to 10s., and preference shareholders will be asked to forgo their right to any fixed cumulative preferential dividend in respect of the three years ending February 28, 1923. The accounts of the company for the year ended June 30 last show a debit balance of £758,415, made up of—loss from manufacturing accounts, £247,017; amount written off on revaluation of stocks, £189,178; depreciation of surplus unworked plant, and losses on plant wholly written off, £281,797; losses on plant sold, £8,627; losses on cancellation of erection contracts, £39,353; less interest and transfer fees, £7,557. A credit balance of £85,007 was brought forward, and the net adverse balance is thus £673,408. To this loss it is proposed to add the two items, preliminary expenses, £305,035, and inaugural expenses, £120,862, making a total debit balance of £1,099,305.

Need for Further Capital

It was announced in June last that a credit of £278,000 (subsequently increased to £302,500) was secured and an additional £150,000 was obtained later, the amounts being secured by second and first debentures respectively. When the latter transaction was arranged it was believed the moneys provided would be sufficient to enable the company to demonstrate that the original expectations of large profits were capable of attainment. Towards the close of last year difficulties again arose in connexion with dyeing, and though very good progress has been made, the trouble has not even yet been overcome, and the financial resources of the company are again exhausted. The board now state that unless more money is placed at the company's disposal the debenture holders must foreclose. If the company were now to be liquidated the directors fear that the whole of the preference and ordinary share capital would be lost.

The Tubize Company

The directors, believing that apart from the question of dyeing the difficulties of manufacturing cellulose acetate silk on a commercial basis have been surmounted, have approached Dunn, Fisher, & Co. with a view to the provision of further funds. As a result, the Fabrique de Soie Artificielle de Tubize has made a thorough investigation of the position of the British Cellulose Co. The representatives of this Belgian company confirmed in the main the views of the British Cellulose directors, and the Tubize Co. has agreed to underwrite £100,000 of the amount now to be raised. Further, an arrangement has been reached whereby the Tubize Co. will lend the Cellulose Co. one of their most capable works managers to assist the latter in reducing costs and training its staff, and also undertakes the sale of cellulose acetate silk in many foreign countries. It will also buy from the Cellulose Co. its immediate requirements of cellulose acetate. In addition, the Faberei & Appretur Gesellschaft vorm A. Clavel & F. Lindemeyer have undertaken the responsibility, for a period of not exceeding two years, of managing the company's dyehouse at Spondon and of so training the company's staff that on the cessation of their management the company can take over control without loss of efficiency. The inventors of the process, M. A. Clavel, Dr. C. Dreyfus, and Dr. H. Dreyfus, have made concessions which should increase the prospective sales of the British Cellulose Co.

Government Assistance

H.M. Government have given their consent to the issue by the company of the new debenture loan, by means of which it is proposed to raise the further capital required, and have agreed to help the scheme by transferring, without consideration, 750,000 of their preference shares to the company which is subscribing to the new debentures. These arrangements having been made, it is proposed that a holding company, to be formed by Dunn, Fisher, & Co., will provide the Cellulose Co. with £500,000.

Under this arrangement the Cellulose Co. will charge its entire assets and undertaking to secure debentures for this amount, which the holding company will subscribe at par. The interest will be 8 per cent., and the new security will be redeemable at the end of twenty years at par by means of

a sinking fund commencing 1927, or at the company's option at any time on six months' notice at 105. The company subscribing for the new debentures will in turn make an issue of £500,000 debentures, secured by a first debenture on its assets. British Cellulose shareholders will be given the right of preferential allotment of this issue, which, in addition to a fixed interest rate, will be entitled to one-third of the distributed profits of the holding company. The Cellulose Co. is to pay annually to the holding company a sum equal to 2½ per cent. on its sales' value until the annual sum so paid reaches £50,000, and thereafter 1 per cent. on the balance. This payment is to be continued for twenty-five years after £50,000 has been so paid in one year. The net amount of new money to be received by the Cellulose Co. will be £336,800, the existing first mortgage debenture of £150,000 and £16,500 of present second debentures being repaid out of the gross amount. This sum of new money, it is believed, will enable the Cellulose Co. to reach an eventual output of about three tons a day. Additional directors approved by the Government have been nominated to the board by the underwriters of the issue.

The annual general meeting of the Cellulose Co. will be held at Cannon Street Hotel, London, on May 1 at 11.30 a.m. If the directors recommendations are carried at the extraordinary general meeting which will be held at the conclusion of the annual meeting, a separate general meeting of the preference shareholders will follow, at which the resolutions necessary to put the scheme into effect, will be proposed.

Low Temperature Carbonisation

Interesting Discussion at Cardiff

DR. C. H. LANDER, representing the Fuel Research Board, opened a discussion at the South Wales Institute of Engineers at Cardiff on April 20 on the "Low Temperature Carbonisation of Coal," in which he said that low temperature carbonisation of bituminous coal as a possible source of home supplies of fuel oil continued to be a problem of national importance. Though the period of scarcity and high prices which resulted from war conditions had been succeeded by a period of plentiful supplies and lower prices, the fact remained that for fuel oil of all kinds this country had to depend upon overseas sources of supply. The absence of control over prices introduced a speculative element which could not be ignored in the consideration of schemes for the production of fuel oils from home sources. It was perhaps fortunate that fuel oil was only one of the three principal products of carbonisation, gas, oils and coke. Of these coke was by far the most important, as it amounted to about 70 per cent. of the weight of coal carbonised, while fuel oil and gas only amounted to about 8 per cent. As coke could be produced in the form of a smokeless solid fuel suitable for domestic service, the profitable working of the process was bound to depend largely upon the recognition by consumers of its superiority to raw coal as a fuel.

Mr. David Brownlie declared the solution of the problem of low temperature carbonisation was the most important event in the industrial history of this country since the invention of the steam engine. There could be extracted from the volatile contents of the coal by carbonisation in closed retorts a whole series of valuable by-products, and the net saving in coal which would result by low temperature treatment would be 75,000,000 tons per annum. The money saving would amount to £200,000,000 per annum. The universal carbonisation of raw coal by low temperature methods would also wipe out once and for all the black smoke trouble, with a consequent saving in Great Britain of over £40,000,000. The process would likewise give over 500,000,000 gallons of motor spirit and 75,000,000 barrels of oil, which would render us independent of the rest of the world; in addition we should have 1,350,000 tons of sulphate of ammonia. Mr. Brownlie said that in his opinion the low temperature carbonisation of coal was the keystone of a national scheme of fuel economy.

Mr. John Roberts dealt with the economic aspects of the question, which he said was of first-rate importance to coal owners and engineers interested in Welsh coal, because the successful development of a process or processes would immediately affect South Wales. He said the importance of the efficient washing and carbonising of high-volatile coals could be not over estimated.

A number of others took part in the discussion, including Mr. N. H. Freeman, of the British Oil and Fuel Conservation, Ltd., and Principal George Knox, of the School of Mines.

Society of Dyers and Colourists

Annual Meeting of the Manchester Section

THE annual meeting of the Manchester Section of the Society of Dyers and Colourists was held at the Manchester College of Technology on Friday, April 21, Professor E. Knecht presiding.

The Hon. Secretary (Mr. L. Thompson) read his Annual Report, in which it was stated that the total membership of the Section was 394, this being an increase upon the previous year. The attendances at the meetings of the Section had been very satisfactory. Arrangements have been made for five further meetings, at which papers of interest and value will be read and discussed.

The election of Members of Committee was then proceeded with, Messrs. J. P. Egan and W. G. Price being appointed scrutineers of the ballot papers. There were twelve vacancies and eighteen nominations. The following eleven members were elected: Mr. J. Campbell Gray, Miss Eva Hibbert, Mr. J. R. Hannay, Mr. S. H. Higgins, Mr. G. E. Holden, Mr. J. Huebner, Professor E. Knecht, Mr. W. Marshall, Mr. W. H. Pennington, Dr. F. M. Rowe, and Mr. L. Thompson (Hon. Secretary). A second ballot was necessary in the case of the remaining vacancy owing to the tieing of Dr. H. F. Coward and Mr. L. Guy Radcliffe. A "tie" between these two gentlemen occurred again, and it was ultimately decided to leave the appointment to the decision of the Committee.

Preparation of Cloth for Finishing

The above-titled paper, by S. H. Higgins, M.Sc., and Andrew Hodge, was then read by Mr. Higgins. The reading of the paper was also supplemented by an address from Mr. Hodge, and by explanations, illustrated on the screen, by Dr. C. S. Harland of the Shirley Institute, Didsbury. After referring to the statement of Mr. W. Howarth at the World Cotton Congress, Manchester, 1921, respecting the characteristics of raw cotton which enabled a spinner to attain the best results with a minimum of labour, Mr. Higgins said the faults in cotton piece goods which hampered the finisher in his attempts to produce the best result were, roughly, cotton faults, mechanical faults, and chemical faults, including those associated with the size.

Dealing with cotton faults, it was stated that "black" cotton could not be bleached to a pure white, the finished piece being dull and almost grey in appearance. Cloth woven from such "black" cotton should never be delivered to white finishers or calico printers, but should be sent for black dyeing. Blue Bender cotton was a variety of Peeler cotton, and had a bluish colour which could not be removed by the usual methods of bleaching. Unripe fibres were responsible for spinning difficulties, resulting in the formation of neps resisting the penetration of the colour. Many cloths, particularly those woven with the coarser counts of yarn, contained a very large proportion of leaf, which remained from a pale buff yellow to dark brown after the goods had received a normal bleach. Leaf was also capable of showing speckiness in the ultimate dyed goods as illustrated in one of the examples.

Chemical Faults

With regard to chemical faults, including those associated with size, these took the form of excessive quantities of size being used, and from the use of undesirable ingredients in the size, such as zinc and magnesium chlorides, paraffin wax, or tallow containing paraffin, and from the use of colouring matters which could not be bleached out. All the size put into the warp had to be removed by the finisher during the process of bleaching and the less he had to remove the better. Many cloths were now delivered free from chlorides, though some of the ready-made softeners sold for use in sizing contained chlorides; a manufacturer buying such products might be using them unwittingly. The use of China clay in sizing light goods was also not to be recommended. Fatty matter in the size was a fruitful source of trouble to the finisher, even when it consisted of pure tallow, which was mainly saponifiable. Some cloths contained as much as 2.5 per cent. of fatty matter, while other similar cloths only contained 0.6 per cent. Many commercial tallows were adulterated with unsaponifiable paraffin wax, which was not removed in the process of bleaching and gave rise to stains in the finished goods. Japan wax, being only partially saponifiable, was not suitable for sizing mixings. Paraffin and similar waxes should not be allowed in

the weaving shed. The practice of covering up a float or other weaving defect with paraffin wax, or soap containing it, was also to be deprecated.

Removal of Stains

Stains due to mineral oil were another difficult problem from the point of view of the finisher. They occurred when there was contact with the yarn or cloth in the course of spinning or weaving, from drippings from the roof or from the slasher cylinder covers, yellow or black bars from cracked bobbins, the oil getting on to the roving, or oil from the roller necks, and in the top boards in the card room. When the weaver pieced a thread an oil stain would result if she had oil on her fingers, and this stain could not be removed in the ordinary bleaching process. Marks from picker bands due to oily and waxy matters in the stuffing of the leather would not come out, but left yellow marks. If lubricating oil had come from a bearing and contained any copper or iron from the machinery the trouble was greatly aggravated. The metallic particles were not completely removed by souring, and acted on the chemic, giving off oxygen, thus tendering the cotton with which they were in contact. It was an exceedingly dangerous practice to attempt to remove these metallic stains by treatment with oxalic acid or salts of sorrel. If the acid was not completely removed by washing, local, and perhaps more than local, tendering might occur.

Bleeding of Dyestuffs

Lard oil was saponifiable in the bleaching process. Some years ago it was shown that by using a lubricating oil containing 75 per cent. of colza oil and 25 per cent. of mineral oil any oil stains would be removed in the bleaching process. White lead stains from looms and other parts of the textile machinery would not bleach out, but left light brown stains. The bleeding of dyestuffs in the bleaching process also caused a considerable amount of trouble. It was more likely for variations to take place in the process of dyeing, which was sometimes a long and difficult one, than in the process of bleaching, which was more or less standardised.

The finisher should insist that no chlorides or unsaponifiable waxes existed in the cloth he received.

A discussion followed in which Messrs. Knecht, Hannay, Thompson, J. Campbell Gray and Jones took part.

Chemical and Dyestuff Traders

Protests against Restrictions on Trade

A CIRCULAR just issued to members of the Chemical and Dyestuff Traders' Association contains the following information:

During the past twelve months the Dyestuffs Act and the Safeguarding of Industries Act have been most carefully watched and as far as possible influenced from their inception. By deputation, personal representations, written suggestions, inquiries and remonstrances, Press propaganda, and establishing regular channels of communication with members of Parliament much thought and energy have been expended and some valuable results achieved. Two early instances may be given. Largely resulting from our initiation chlorate of potash was taken out of the dutiable list under Part I. of the Safeguarding of Industries Act and placed in the "R" category. This not only obviated duty being charged on consignments coming forward, but enabled some of our members to recover duty paid upon consignments that had previously arrived. Upon learning that antimony salt was being charged with the duty of 33½ per cent. on consignments that were arriving we took up the case, and after much trouble established the ruling that this article was not in the list, and therefore not subject to duty.

Safeguarding of Industries Act

Our Association has taken, mainly through its officials, a very close, active, and persistent part in all the cases relating to our trade that have come before the Referee and also the committees of investigation. The successes secured have in no small degree resulted from information supplied and evidence tendered by us. Much further work of this nature remains to be done, especially if and when Part II. of the Act becomes operative.

We have also watched very closely the operations of the Dyestuffs Act, and have been unceasingly vigilant in the

endeavour to ascertain, reveal, and redress, detriment and prejudice sustained by traders. Our action has undoubtedly greatly helped in creating the growing feeling that both Acts will have to be repealed, as they do not accomplish their avowed object, but do result in the restraint and diversion of trade.

On April 6 we learned by 'phone from the Board of Trade that thirty-six chemical products had been removed from the list of articles subjected to a duty of 33½ per cent. under Part I. of the Safeguarding of Industries Act, and could from that date be imported free of duty; also that nine other chemical products were removed from the general dutiable list and placed in the "R" category. There is no doubt that this most important voluntary concession was made because of the successes achieved in obtaining decisions from the Referee that santonine, calcium carbide, gas mantles, lactose, cream of tartar, tartaric acid, and citric acid had been improperly included in the dutiable list. The fact that notifications of complaints had been made to the Board of Trade with regard to each of the articles voluntarily released would doubtless further influence them in the action taken.

We have no desire to claim any undue credit, but the Chemical and Dyestuffs Traders' Association can fairly and confidently assert that without their sustained activities the successes notified would not have been achieved. There are numerous other articles still to be removed, including oxalic acid, lactic acid, formic acid, formaldehyde, &c., and it is of paramount importance that our membership must not only be maintained but increased if the collective interests of the trade are to be effectively safeguarded.

Duty on Containers

The Association has for some time been in correspondence with Customs respecting the duty charged on containers, which it contended was unreasonable and unfair. The point was raised by country members who had been obliged to pay this duty. Repeated letters were sent to Customs and questions put in Parliament at the instance of the Association. The reply in Parliament was decidedly evasive, as are most Government replies to questions on the Safeguarding of Industries Act. To say that no duty is charged on containers as such is surely begging the question. If the duty is charged on the whole consignment, which includes containers, then the containers must pay duty. Otherwise why is not the duty levied on the value of the article alone? That duty is charged is evidenced by the following letter we received from Customs on the 12th inst., in which they say that an allowance will be made:

"In reply to your letter of December 22 last and subsequent letters with reference to the inclusion in the value for Key Industry Duty purposes of iron drums containing imported chemicals, I am directed by the Commissioners of Customs and Excise to inform you that a claim in respect of an allowance made by the supplier on return of the drums will be considered by them on production of (1) credit notes from the supplier for the drums returned, (2) documentary evidence showing the cost to the British purchaser of the return of the drums."

It is, at any rate, satisfactory that this much has been gained by the correspondence.

Containers Sent to Germany

With regard to these we have been in communication with the Board of Trade, and are informed that exemption from Reparation tax is granted to (1) goods sent to a German trader in fulfilment of a contract for sale and rejected by him as not being of the quality ordered, and (2) goods consigned to an agent in Germany for the purpose of sale, but returned unsold.

An application under this exemption must be made to the Collector of Customs and Excise at the port of importation, accompanied by a statutory declaration as to compliance with (a) that such article was sent from the United Kingdom to Germany, (b) that such article was returned from Germany to the United Kingdom unaltered, and (c) that the property in such article still remains in the person by whom it was consigned from the United Kingdom to Germany, supported by documentary evidence in the form of bills of lading, invoices, and correspondence. If necessary, delivery under bond will be allowed while the application is under investigation. Empty packages returned from Germany are regarded as covered by this exemption.

Disclosure of Manufacturers' Names

This question has been raised several times with the Board of Trade and has been referred to in previous circulars. We are now enabled to announce a concession in relation to goods imported into Belgium as the following correspondence with the Board of Trade will show: "Some of our members are exporting chemicals and other produce from this country to Belgium, and have been notified that the Belgian authorities are now demanding a certificate of origin endorsed on the back of the invoice, stating that the goods supplied are not of German manufacture and have been bought from such and such a firm in the United Kingdom. It is most unfair that they should be called upon to divulge the name of their suppliers, and we would, therefore, be glad if you would make the necessary representations to the Belgian Government. We think that if they endorsed the invoice to the effect that the goods are not of German origin and have been bought by them from a firm in the United Kingdom, it should be sufficient for the authorities in Belgium."

The Board of Trade in reply state: "With reference to your letter of November 26, respecting certificates of origin for goods imported into Belgium, I am directed by the Board of Trade to state that they learn, through the Foreign Office, that the Belgian Government has decided to recognise as valid the attestation of Chambers of Commerce in this country, which are affiliated to the Association of British Chambers of Commerce, to exporters' declarations of origin, as from April 14. The Chambers of Commerce are entitled to charge a fee not exceeding one franc (gold) for their service in this connexion."

Continuous Vacuum Filters

Their Use, Construction and Operation

ALTHOUGH the use of mechanical filters is probably not a century old, the last decade has produced an array of diverse types which may conveniently be grouped under one of the following heads:—gravity, press, positive pressure, and vacuum filters. Claimed to be the pioneer in the field of continuous vacuum filtration, the Oliver continuous filter, the standard type of which is shown in Fig. 1, has been specially designed for the treatment of many chemical products. Widely used in the U.S.A. during the war for the filtration of

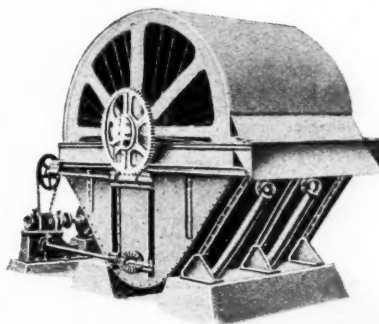


FIG. 1.

ammonium nitrate liquors, it is claimed to be particularly suitable for the filtration of sulphate of lime. More recently its use has been extended to the filtration of lime mud produced in the causticising process for the manufacture of caustic soda and in the manufacture of starch and gluten. In the treatment of dyestuffs of both acidic and basic characters, the Oliver filter is stated to have been successful, while the filtration of phosphoric acid solutions has been successfully undertaken in specially constructed machines.

The Oliver continuous filter consists of a drum or cylinder rotating on a horizontal axis, with the lower portion submerged in a tank containing the material to be filtered. The surface of the drum is divided into compartments or sections, the dividing partitions being parallel to the main shaft. These sections are covered with a screen for supporting the filter medium, which is held in place and protected from wear by a wire-winding, the use of which is covered by patents.

Each of these sections of the drum is connected by means of pipes passing through a hollow trunnion to an automatic valve, which controls not only the application of the vacuum for forming and washing the cake, but also the admission of air for discharging the cake. By reason of this arrangement each compartment forms virtually an independent unit, although the filtering medium is attached as a continuous sheeting over the whole surface of the drum.

A scraper is fitted across the face of the drum and rests against the wire-winding in such a manner that the "cake" or residue is entirely removed after being released by air or steam pressure. The wire-winding prevents cutting of the filter medium by the scraper. An agitator is placed in the tank beneath the drum in order to keep the heavier particles in the pulp in suspension and also to assure a uniform cake.

Arranged radially in the interior of the drum is a system of pipes connecting each compartment with the automatic valve which controls the application of a vacuum and the admission of compressed air or steam. The automatic valve, which controls the whole cycle of operations, consists of a flat valve plate with a number of round parts corresponding with the compartments on the surface of the filter drum. The pipes for the vacuum or compressed air connect to these parts. The valve chamber is provided with annular members corresponding to the different stages in the process. The valve is so constructed that there is an automatic separation of the mother liquor and the wash water.

Steel is the material most commonly used in the construction of the tank, although for special conditions, lead, copper, cast-iron, redwood or maple are employed. Its shape depends on the type of material treated and the type of agitator required. The function of the agitator is to prevent the heavy particles from settling and to maintain a homogeneous mixture. The paddle agitator is most generally used, although the treatment of certain types of materials an oscillating agitator is said to give better results. Fig. 2 shows the oscillator type of machine fitted with enclosed steel heads and a

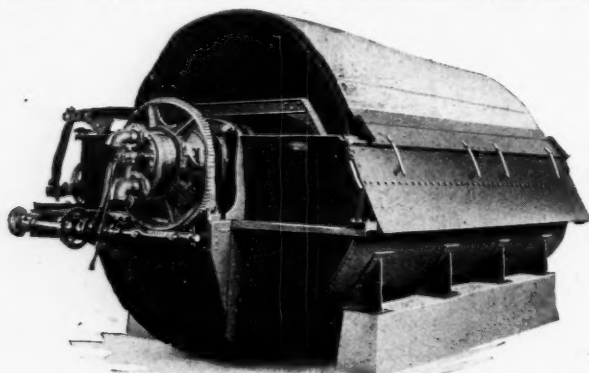


FIG. 2.

valve with two outlets for separating the wash effluent from the main filtrate. Compressed air admitted through perforated pipes in the bottom of the tank in many cases provides effective agitation without the use of mechanical agitators.

Keyed to the trunnion on the valve end of the drum is a worm gear, meshing in a steel worm driven from any convenient source of motive power. The speed at which the drum is rotated depends upon the filtering characteristics of the material treated, and may vary from one revolution per minute to one revolution in ten minutes.

Materials ranging in temperature from 10°-90°C. may be treated in the Oliver filter, as provision is made in the vacuum system for the condensation of hot vapours and gases. The condensate from such vapours is not mixed with the filtrate, and may be returned to the system if desired.

On the discharge side of the tank a flexible steel scraper bears lightly against the wire-winding and removes the cake as it is loosened by compressed air. Below the scraper is an apron which directs the discharged cake on to a belt conveyor. Special types of filter for use in laboratories and small test plants are supplied with a capacity of from 500 lb. to 1 ton of dry solids per day.

The plant is manufactured by the Oliver Continuous Filter Co., of San Francisco and New York, whose London offices are at 11-13, Southampton Row, London.

The United Alkali Company

Mr. Max Muspratt on Taxation

THE adjourned thirtieth ordinary general meeting and the thirty-first ordinary general meeting of shareholders of the United Alkali Co., Ltd., were held at Liverpool on Tuesday, Mr. Max Muspratt (the chairman) presiding. Completed accounts for the year ended December 31, 1920, were now presented. Pending a final settlement in respect of war taxation, the accounts for 1921 could not be prepared, but the directors hoped that at a comparatively early date they would be presented.

Dealing with the incidence of taxation, Mr. Muspratt drew attention to the item of £296,000 which represented the firm's taxation in 1920. However necessary or fair this taxation was in principle, he felt that its incidence in times such as we had recently passed through was intolerable. It meant that for every pound paid to their debenture-holders and shareholders for 1920 the company had to meet 23s. in taxation. Under such conditions it was an impossible task to do justice to shareholders without seriously crippling the permanent interests of the company. The same conditions in accentuated form had affected the figures for 1921, but with the final cessation of excess profits duty, and an approximate stabilisation of values, it was to be hoped that they were near a conclusion of this deadly drain on their resources, and might expect to enjoy that degree of prosperity which their general position justified them in expecting.

Features of 1921 Trade

The general situation in 1921 was summarised by the chairman as follows:—The first three months they were struggling against the effects of the trade slump; reducing production and trying to reduce costs of production to meet the changed conditions. Then came the great disaster of the three months' coal stoppage, which converted acute depression into absolute paralysis for four or five months. In August they had turned the corner, but the results up to August 31, accentuated by the writing down of stocks, showed a heavy loss. The remaining four months, though trade was still bad, were fairly satisfactory, particularly for export; but the result for the whole year could only be described as bad. This would surprise nobody when the prolonged stoppage of the company's works, due to lack of coal, was borne in mind.

In the course of the year 1921 they paid no less than £500,000 in taxes, and although nearly half was covered by securities earmarked for that purpose, finding the balance in cash in such a year made it impossible to pay more than a portion of the preference dividend.

All the fundamental plant alterations reported in recent years were working in a most satisfactory manner. Their ammonia soda works extension was started in December last without a hitch, and the product was at present well absorbed by the market, or by the subsidiary plants for caustic soda and soda crystals, which were at present, at any rate, working at full capacity. At Newcastle the electrolytic plants were working almost full time, but at Widnes the similar plants were still on reduced load, as the demand for chlorine products, owing to the depression in the paper trade and textile industry, was still far below the normal. The position was, however, improving week by week, if only slowly, and every increase in consumption represented a decrease in cost, which they were handing on to the consumer in the hope of further stimulating consumption.

Sulphuric Acid Position

The position with regard to sulphuric acid had been extraordinarily difficult for them, as for the many other makers of that product. The main consumption was for the manufacture of superphosphate and ammonium sulphate, and the grave depression of agriculture, combined with other causes, had created absolute chaos in those industries. The result was a reduction of consumption to about 30 per cent. of the normal, and as sulphuric acid required large and expensive plant, the standing charges were heavy, with the result that all reductions in raw materials and labour were more than counterbalanced by the standing charges. This problem had been met by concentrating production in the most efficient works with most satisfactory results, retaining skeleton staffs in the plants that were idle, thus enabling the company to make substantial reductions in their prices to consumers, and so stimulating consumption. The results of this policy had been a slow but steady improvement of the demand for this important product.

Their mines in Spain, which to a considerable extent supplied the raw material for the sulphuric acid, had been badly affected by the abnormal reduction in consumption, and their copper works, which played an important part in the complicated cycle of operations of which sulphuric acid was the main product, had been brought to a complete standstill through economic changes resulting from the war. A deputation of directors had recently spent some weeks in Spain, and the board were confident that they had adopted a policy suitable to the changed conditions and of considerable advantage to the company's present operations and future prospects.

Development of Dye Production

Considering the condition of world trade, continued Mr. Muspratt, the situation in regard to the company's main products was not unsatisfactory, but the developments they had made in organic products to assist the dye industry were at present under a cloud, partly due to the great depression in the textile industry, and partly from the erratic policy of the dye producers, although individual members had welcomed the company's attempts to assist them in this problem. The board appreciated the national importance of this question, and intended to take a part in the solution of the many problems associated with it.

In another direction they had made developments. Many of their products were suitable for domestic consumption but, apart from soda crystals, had not been available in convenient form. They had, however, had a small package trade at their Greenbank Works, which had become obsolete on the technical side. This had been transferred to Widnes, and it was intended to develop it with up-to-date plant.

Dr. G. C. Clayton then spoke of the happy relations which had existed with the employees of the company during the year in spite of reductions, which were accepted without complaint and without prejudice to the work done. Their workpeople, in fact, were working very well. During the period of slackness in the organic manufacturing department great progress was made in developing new processes of manufacture, and they were well prepared to meet any demands that might be made upon the company when the dyeing industry revived. Those shareholders who visited the British Industries Fair in London would have been impressed with the large range of products which the company could now produce, and for which they hoped there would soon be a steady demand.

New Safeguarding Act Committee

THE Board of Trade give notice that they have received under Sec. 2 (1) (b) of the Safeguarding of Industries Act a complaint by the British Optical Instrument Manufacturers' Association, Ltd., the British Photographic Manufacturers' Association, the Spectacle Manufacturers' Association, and the Drawing Instrument Manufacturers' Association in regard to the sale of optical and other scientific instruments manufactured in Germany. The Board of Trade, in exercise of the powers conferred upon them by Part II. of the Safeguarding of Industries Act, 1921, have referred the matter for inquiry to a Committee constituted for the purpose of that Part of the Act and consisting of Sir R. Henry Rew (Chairman), Mr. A. K. Davies, Mr. Rayner Goddard, Mr. A. E. Holmes, and Mr. J. F. Mason. The Committee propose to hold their first sitting for the taking of evidence at 3 p.m. on Monday, May 15, at the Hotel Windsor (Mines Department), Victoria Street, London. The Secretary to the Committee is Mr. T. Turner, Board of Trade, Great George Street, London, to whom all communications should be addressed.

New Australian Tanning Bark

It is reported that over 170 samples of bark, possibly capable of use in the tanning industry, have lately been examined in the Forest Products Laboratory of the Institute of Science and Industry in Western Australia. It has been found that karri bark (eucalyptus diversicolour) yields the most successful results, for it shows an average tanning content of about 20 per cent., tans quickly, and gives a light-coloured leather. Now that its potential value has been demonstrated the manufacture of a karri tanning extract has been initiated, and the bark, instead of being wasted after stripping at the saw mills, will be preserved at the rate of about 10 tons per day. Detailed results of the survey will shortly be published by the Federal Institute of Science and Industry.

Chemical Matters in Parliament

The German Dye Trust

MAJOR MACKENZIE WOOD (House of Commons, April 26) asked the President of the Board of Trade whether his attention had been called to the reported alliance between La Compagnie Nationale des Matières Colorantes et des Produits Chimiques, the trading makers of dyes in France, and the Interessen Gemeinschaft, the German dye trust, under which the Germans had agreed to assist the French company and disclose their trade secrets in consideration of the French undertaking to confine their sales to France and its colonies and to hand over 50 per cent. of their profits to the German trust; whether this arrangement had been communicated to the Reparations Commission; and what effect, if any, it would have on the delivery of dyes under the reparation clauses of the Treaty of Versailles.

Sir William Mitchell-Thomson said he had seen statements to the effect that some agreement had been made between the French company mentioned and the Interessen Gemeinschaft, but he had no official information as to its precise nature, and he was not aware that it had been communicated to the Reparations Commission. It did not appear that any such private agreement could have any effect on the delivery of dyestuffs under the reparation clauses of the Treaty of Versailles. In reply to Dr. Murray, he said he was not aware that Italy contemplated a similar agreement. Answering a further question by Mr. Kiley, he said he was not aware that the British Cellulose and Chemical Manufacturing Co., Ltd., in which the Government had a substantial interest, were proposing to engage a German staff.

Contracts Open

TENDERS are invited for the supply of the following materials. The latest date for receiving tenders is (when available) given in parentheses:

RICHMOND (May 9).—Buxton lime, grey lime, sewage precipitants. Particulars from W. Fairley, West Hall Road, Kew Gardens, Surrey. Tenders to J. L. G. Powell, Sessions House, Richmond, Surrey.

SALFORD.—Reciprocating pumps for sewage works. Particulars from J. Diggle & Son, 14, Brown Street, Manchester.

HALIFAX.—Rotary screen, picking belt, hoppers, conveyors, briquetting plant, &c. Particulars from W. H. Sagar, Hall Street, Halifax.

MARYLEBONE (May 8).—Elevator for refuse. Particulars from Highways Engineer, St. Marylebone Borough Council. Tenders to J. Wilson, Town Clerk.

MANCHESTER (May 9).—Hydro-extractors. Particulars from and tenders to City Architect, Town Hall, Manchester.

Petroleum Lectures at Chelsea

A SHORT course of ten lectures on the chemistry and technology of petroleum has been arranged at the South-Western Polytechnic Institute, Manresa Road, Chelsea, and the lectures will be delivered by Mr. F. Esling on Thursday afternoons commencing on April 27, at 2 p.m. The course will deal with matters of interest to those engaged in the petroleum and fuel industries, to technical men wishing to gain a general knowledge of the subject, and to students. The syllabus includes the occurrence, origin, finding, winning, handling, and storage of petroleum, refining of crude products; wax pressing and lubricating oil manufacture; methods of determining specific gravity, flash points, &c.; composition and chemical constitution; lubricants and lubrication; and general uses and applications. A practical class will be held immediately after each lecture at which demonstrations will be given of the apparatus and methods employed in testing and examining petroleum and petroleum products. Facilities will be given for the members of this class to gain practical experience with all the usual apparatus used for petroleum testing. The treatment of crude petroleum distillates on a small scale and the chemical examination of the oils will also be studied.

Further information regarding the scope of the course, fees, &c., may be obtained from Mr. J. B. Coleman, F.I.C., Head of the Chemical Department of the Institute.

From Week to Week

There were TEN FATAL ACCIDENTS in United Kingdom chemical works during March.

SIR FRANK SWETTENHAM has been nominated chairman of the Rubber Growers' Association.

DR. F. JOHNSON has been elected chairman of the Birmingham Section of the Institute of Metals for the ensuing year.

JOHN KNIGHT, LTD., of Silvertown, London, have been honoured by appointment as soapmakers to the Prince of Wales.

MR. JOHN EMSLEY was elected president of the Textile Institute at the annual meeting of that body in Manchester on Tuesday.

DR. C. H. HERTY has been re-elected president of the Synthetic Organic Chemical Manufacturers' Association of the United States.

MR. H. C. WILSON, of Tomlinson & Hayward, agricultural chemists, has been appointed a justice of the peace for the City of Lincoln.

MR. GEORGE GIBB has been appointed a member of the Board for Mining Examinations in the place of the late Mr. John Gemmell.

It is reported that Mr. GEORGE VERNON CLAY, formerly Chairman of the Colour Users' Association, has resigned his seat on the board of the British Dyestuffs Corporation, Ltd.

According to reports from Copenhagen, the NORTH-WESTERN CYANIDE CO., of Odda, has failed, its liabilities amounting to 18,000,000 kroner and its assets to 4,000,000 kroner.

LORD LEVERHULME was, on April 22, officially received by the town council of Termonde, and was made a Freeman in recognition of the part which he had played in its reconstruction.

MR. W. S. CURPHEY, late Chief Inspector of Alkali Works, died on April 25 after an operation, at the age of sixty-six. The funeral takes place at Golders Green Crematorium at noon to-day (Saturday).

The Anglo-American Oil Co., Ltd., Minerva House, Bevis Marks, London, announce that they are in a position to supply on favourable terms ISO PROPYL ALCOHOL, which they are marketing under the brand name of "Petrohol."

The Institution of British Foundrymen will be holding at Bingley Hall, Birmingham, from June 20-23, an important FOUNDRY TRADES EXHIBITION, the first of the kind ever held in Europe. The Duke of York has promised to visit it.

The death has occurred at the age of twenty-two of Mr. A. J. LESLIE THOMAS, a laboratory assistant at the Briton Ferry Iron Works, where his ability and application to work had won for him high esteem. The funeral took place at Ynysmaerdy Cemetery on April 20.

It is reported that the MANUFACTURE OF CHEMICALS in Sweden has partly ceased owing to German competition, which has driven prices down. The output of superphosphate tends to increase compared with 1920, though it is still only 75 per cent. of the 1913 production.

The terms of the recent settlement of the STRIKE OF CHEMICAL WORKERS in South Wales provide that the employers are to dismiss the men who were temporarily engaged during the progress of the dispute, and that no further reduction in wages is to be applied for until next November.

For reasons of health, MR. EDWARD MOUNT has resigned his position as secretary of the United Alkali Co., Ltd. As assistant secretary to the company at its start, and then as secretary, he has rendered long and faithful service and has acted most successfully as an expert in the sale of copper.

Mr. Alfred Edwin Sadler, of Sandhall, Ulverston, Lancashire, has died at Stokesley after a lengthy illness. Mr. Sadler, who was sixty-four years old, was joint managing director, with Mr. Stanley Sadler, of Sadler & Co., Ltd., chemical manufacturers, whose works at Middlesbrough were founded by the late Sir Samuel Sadler.

Experiments are being conducted at tinplate works at Swansea having for their object the SUBSTITUTION OF NICKEL for the tin with which tinplates are coated. A company has been formed to deal with the invention under the style of the Steel Nickel Syndicate, a prominent member of which is Mr. Henry Mond, son of Sir Alfred Mond. The production of rustless plate is contemplated.

We regret to record the death, on April 19, at The Nook, Wake Green Road, Moseley, Birmingham, of MR. JAMES SPILSBURY, F.I.C., in his seventieth year. He had resided in Birmingham for many years, and was at one time a member of the firm of Blackwell, Hayes, & Co., manufacturing chemists, of Moor Street. On retiring from the firm he practised as an analytical and consulting chemist at Moseley. His son is Dr. Bernard Spilsbury, the toxicologist, whose name has figured prominently as an expert witness in several recent poison trials.

With reference to the arrangement between William Varcoe & Sons, Ltd., the Cornish Kaolin, Ltd., and the Tehidy Minerals, Ltd., the first-mentioned company announce that the pottery business will still be conducted under the management of Mr. Wentworth Varcoe. The business at 93, Market Street, Manchester, which includes whiting, barytes, French chalk, mineral white, &c., besides china clay, will be conducted as heretofore by Mr. Grosvenor Varcoe. Both Mr. Wentworth Varcoe and Mr. Grosvenor Varcoe are directors of William Varcoe & Sons, Ltd.

The annual meeting of the MINING INSTITUTE OF SCOTLAND was held in the Technical College, Glasgow, on April 22, when Mr. G. L. Kerr submitted the report of the council for the year, which gave the number of members at 693, an increase of ten compared with the previous year. It showed that during the year a student section of the institute had been inaugurated, and had attained a membership of fifty-one, of whom twenty-three were junior students. The balance-sheet showed that the financial position of the institute was well maintained. Thirty new members were elected, including associate members, associates, and students. The office-bearers elected were: President, Mr. Wallace Thorneycroft; vice-presidents, Mr. W. H. Telfer and Mr. J. Balfour Sneddon.

It is officially stated that the reports which have appeared in some sections of the Press to the effect that the existing agreements between the Anglo-Persian Oil Co., Ltd., and Shell-Mex, Ltd., have been renewed for a period of five years, or that the Shell Co. have effected a WORKING AGREEMENT to sell the Anglo-Persian products in this country for this period, are incorrect. The Anglo-Persian Co. will, after the end of this year, sell the whole of its products through its own distributing organisations to such extent as these organisations are able to market them. The foundation for the rumour is doubtless that the Anglo-Persian Co. has sold to the Shell Co. on advantageous terms a comparatively small estimated excess quantity of one of its products for a period of five years.

Speaking on Tuesday at a luncheon at the Midland Hotel, Manchester, which followed the annual meeting of the Textile Institute, Mr. H. Sutcliffe Smith, of the Bradford Dyers' Association, referred to the recent LEGISLATION CONCERNING THE DYE INDUSTRY. Mr. Smith said he did not want to enter into any controversial matters, but he would like to emphasise the fact that if, either through inefficiency or any other reason, we did not establish the dye industry in this country it would be calamitous for Great Britain. The incidence of the Dyestuffs Act, he considered, pressed most hardly upon the textile trade. The present prices were considerably higher than economic prices ruling for other commodities. He need hardly point out that if prices were to come down every item must be considered. There had been a drop in every item in the textile trade out of all proportion to the drop in the price of dyes.

At a recent meeting of the Manchester Geological and Mining Society, MR. JAMES LOMAX described the results of a microscopical examination of a substance known as "batt" in many districts and as "bustle" in others. It was looked upon with great suspicion as being a probable cause of spontaneous combustion in coal seams. He believed that "batt" was formed by the action of micro-organisms—micro-fungi and bacteria—which operated at or near the surface of the vegetable deposits which were converted into coal. This action ceased when the deposits were covered by the roof of sandstone or shale, but the product was left in such a condition that, when the seam came to be worked and this substance was exposed to atmospheric influences, oxidation began and heat was generated. The question had been put by the Department Committee on Spontaneous Combustion whether the bacteria could renew their activities. His answer was that bacteria in coal occurred only as fossilised or dead matter; it was impossible, therefore, for them to become alive or active again.

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- Determination of esters in imitation flavouring extracts. G. F. Beyer. *J. Ind. Eng. Chem.*, April, 1922, pp. 324-325.
- Tests of an iodine pentoxide indicator for carbon monoxide. S. H. Katz and J. J. Bloomfield. *J. Ind. Eng. Chem.*, April, 1922, pp. 304-306.
- CORROSION. Control of corrosion by deactivation of water. F. N. Speller. *J. Franklin Inst.*, April, 1922, pp. 515-542.

- INTERMEDIATES. The manufacture of meta-tolylene-diamine. H. M. Gensel. *Color Td. J.*, April, 1922, pp. 145-146.
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- TANNINS. The production of chestnut tree extracts; the past, recent development, and future of the industry. Part II. E. Depassé. *Chim. et Ind.*, March, 1922, pp. 458-464.
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- BICARBONATES. The preparation of sodium bicarbonate. E. Toporescu. *Compt. rend.*, March 27, 1922, pp. 870-873.
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- REACTIONS. Kinetic study of alkaline solutions of iodine. O. Liévin. *Compt. rend.*, March 27, 1922, pp. 868-870.
- RARE GASES. The estimation of krypton and xenon by spectrophotometry. C. Moureu and A. Lepape. *Compt. rend.*, April 3, 1922, pp. 908-913.
- CHLOROTOLUENES. The monochlorotoluenes. A. Wahl, G. Normand, and G. Vermeylen. *Compt. rend.*, April 3, 1922, pp. 946-949.
- COMPLEX COMPOUNDS. The hydrolysis of roseocobaltic salts. P. Job. *Compt. rend.*, April 3, 1922, pp. 943-946.
- DIAZO COMPOUNDS. Diazo compounds. Part II. E. Noelting. *Rev. gén. des Matières Colorantes*, April, 1922, pp. 49-52.
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- SYSTEMS. The system water-alcohol-carbon disulphide. N. Schoorl and A. Regenbogen. *Rec. Trav. Chim. des Pays-Bas*, March 15, 1922, pp. 125-134.
- FATS. Wool fat; its production, separation and application. G. Hartmann. *Chem. Weekblad*; Part I., March 25, 1922, pp. 117-119; Part II., April 8, 1922, pp. 143-146.
- ANALYSIS. Analysis of zinc dusts. E. Beyne. *Bull. Soc. Chim. Belg.*, January, 1922, pp. 10-15.
- The estimation of caffeine by means of silicotungstic acid. A. Azadian. *Bull. Soc. Chim. Belg.*, January, 1922, pp. 15-18.
- The estimation of carbon in iron and steel using the Cortes apparatus. G. Batta and H. Thyssen. *Bull. Soc. Chim. Belg.*, March, 1922, pp. 112-117.
- SOLVENT RECOVERY. Recuperation of volatile solvents. P. Brasseur. *Bull. Fed. Ind. Chim. Belg.*, January, 1922, pp. 155-167.
- FERTILISERS. The manufacture of nitrogenous fertilisers. Part I. O. Nydegger. *Bull. Fed. Ind. Chim. Belg.*, February, 1922, pp. 187-196.

Patent Literature

Abstracts of Complete Specifications

- 177,180. DECOLORISING CARBON, PROCESS FOR THE REGENERATION OF. J. N. A. Sauer, den Texstraat 2, Amsterdam. Application date, June 20, 1919.

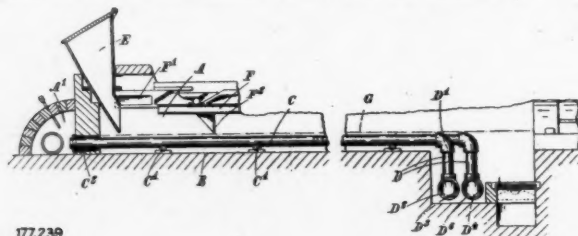
The process is for regenerating carbon which has been used for removing non-soluble, soluble, or semi-soluble substances, such as iron, manganese and other compounds, micro-organisms, &c., from liquids such as sugar solutions. The decolorising carbon is boiled with a 2 per cent. aqueous solution of hydrochloric acid for about one hour, and the acid paste thus obtained is diluted with a large quantity of hot water and then filtered in a press. The carbon is then washed with hot water to remove all soluble substances. When the carbon has been regenerated several times in this manner, the acid treatment alone is not sufficient to restore its activity, and it must be combined with a re-burning treatment. The burning is preferably effected before the acid treatment in order that organic compounds of calcium are converted into calcium carbonate, which in the subsequent acid treatment is converted into a soluble salt and washed out. Alternatively, the carbon may be regenerated by subjecting it to an acid treatment, a re-burning, and a second acid treatment in succession.

- 177,189. ALKYL SULPHATES, MANUFACTURE OF. H. Dreyfus, 8, Waterloo Place, London, S.W. 1. Application date, September 29, 1920.

The process is more particularly for the manufacture of diethyl sulphate and its homologues. These products are obtained by the reaction between sodium pyrosulphate or sodium chlor-sulphonate and ethyl alcohol or ethyl ether or other corresponding alcohol or ether. The mixture is then distilled under reduced pressure. Sodium pyrosulphate may be manufactured by heating sodium bisulphate *in vacuo* or by combining sulphur trioxide with sodium sulphate. Sodium chlor-sulphonate may be made by combining sulphur trioxide with sodium chloride. In an example, a mixture of sodium pyrosulphate and alcohol is heated under a reflux condenser at 80°-100°C. for 4-5 hours; the mixture is then distilled *in vacuo* and a high yield of diethyl sulphate is obtained. In another example, sodium pyrosulphate is heated to 150°C. and alcohol vapour passed over it at reduced pressure. The diethyl sulphate and any excess of alcohol distil off continuously and are subsequently separated. Ether or a mixture of ether and alcohol may be used instead of alcohol. The process may also be applied to the production of homologues of diethyl sulphate by using the corresponding homologues, such as methyl, propyl, or butyl alcohol or ether.

- 177,239. LOW TEMPERATURE DISTILLATION. E. Barrs, 6, South Square, Gray's Inn, London, W.C. 1. Application date, December 20, 1920.

Low temperature distillation retorts, which are provided with a fire clay bottom containing the heating flue, are subjected to destructive abrasion of the upper surface of the floor due to the continuous passage of the material over it.



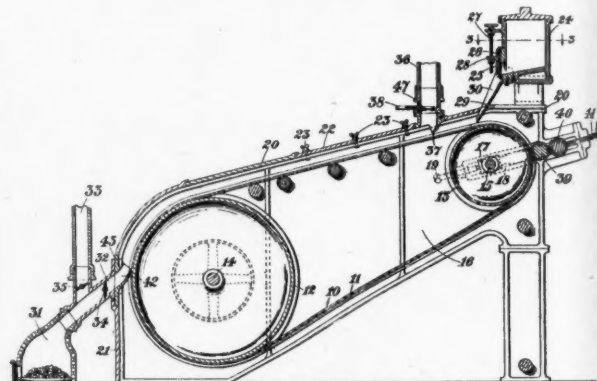
177,239

In this invention the cost of upkeep of such a floor is avoided by forming it of coal, in which the heating flues are embedded. The foundation B of the retort is of fireclay and carries rollers C¹ which support the horizontal metal heating flues C, each of which is provided with a stuffing box C² in the rear wall of the retort. A common collecting chamber A¹ is provided for waste gases. The forward end of each heating flue is provided with a downward extension D, which may be

connected in pairs to another right angled extension D³. A slight turning movement of the heating flues about the extensions D¹ and D² is permitted. The material is supplied through the hopper E and is carried forward by a reciprocating rabble F carrying projecting grids F². The lower ends of the grids move forward along the line G and return at a higher level so that the material under treatment provides its own working bottom at the level G, and the flues C are embedded in it. The flues are not necessarily of metal, especially if corrosive gases are to be used as the heating medium. The floor may then be made up of partly distilled coal tamped into position around cores which are afterwards withdrawn to form the heating flues. The heat is more efficiently transmitted through such a floor.

- 177,262. LATEX, TREATMENT OF. H. A. Wickham & Roa, Ltd., 9-11, Fenchurch Avenue, London, E.C. 3. Application date, December 23, 1920.

Latex is supplied from the reservoir 24 down a shoot 29, the amount being regulated by a sluice 26. The latex is received on a travelling band 10, which is provided with marginal flanges 11 to prevent overflowing. The band is carried on drums 12, 13, and its tension may be adjusted by sliding the spindle 15 by means of set screws 19. The smoke or coagulating fumes are generated in a furnace 31, and are passed into the chamber 20 through a conduit 42 controlled



177,262

by a damper 34. A smoke outlet 36 is provided immediately in front of the shoot 29, and the smoke is delivered outwards by a baffle 37. The cured product is removed by cutting through across its length and introducing the cut end of the layer between the rollers 39, 40. On rotation of these rollers the layer of cured material is drawn between them and compressed at the same time. Alternatively, the cured latex may be continuously removed from the band 10 and fresh latex continuously fed on to it, if the speed of the band is adjusted so that complete curing takes place in one passage through the apparatus.

- 177,283. DERIVATIVES OF 3:3'-DIAMINO-4:4'-DIHYDROXY-ARSENOBENZENE, MANUFACTURE OF. Boots Pure Drug Co., Ltd., and L. Anderson, Station Street, Nottingham. Application date, January 7, 1921.

The object is to obtain a neutral water-soluble derivative of 3:3'-diamino-4:4'-dihydroxy-arsenobenzene which is suitable for medicinal purposes, which is not readily oxidisable by the atmosphere, and is not liable to precipitation when diluted or made alkaline or acid. The 3:3'-diamino-4:4'-dihydroxy-arsenobenzene is dissolved in caustic soda and a 50 per cent. solution of glucose added. The solution is then neutralised with hydrochloric acid and the resulting solution contains a compound of the base and glucose with some uncombined glucose. The compound need not necessarily be isolated, but may be precipitated by the use of organic solvents such as alcohol or acetone. In an alternative, the reaction may be effected by suspending the 3:3'-diamino-4:4'-dihydroxy-arsenobenzene in the glucose and warming on a steam bath.

177,310. PYROSULPHATES, MANUFACTURE OF. British Cellulose & Chemical Manufacturing Co., Ltd., 8, Waterloo Place, London, S.W. 1, and W. Bader, of British Cellulose & Chemical Manufacturing Co., Ltd., Spondon, Derby. Application date, January 20, 1921.

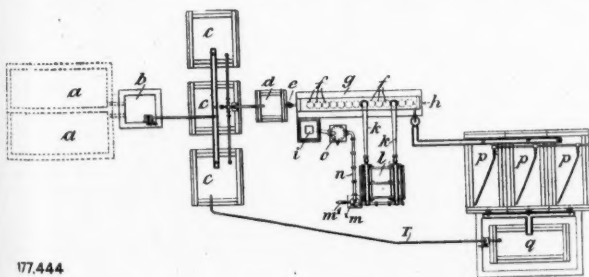
The known process for manufacturing the pyrosulphates of the alkali metals and ammonia by heating the corresponding acid sulphates under low pressure at a temperature of 260°-320°C., produces a very hard and dense material which is difficult to reduce to powder, although the powder is usually required in most technical applications of pyrosulphates. In this invention, the bisulphate is heated to a temperature of 220°C. under a vacuum of about 28 in. The reaction is vigorous at this temperature and is complete at 250°C. The product is subjected to continuous agitation and the temperature at the end of the reaction must be kept below the melting point of the pyrosulphate. Under these conditions the solid material obtained is porous and friable, and is readily ground to a crystalline powder. The pulverising may be effected by continuing the rotation of the agitating device. The raw material used may be sodium bisulphate, nitre-cake, or a mixture of sulphuric acid and sodium sulphate. The heating may be effected by passing an alternating electric current through the molten bisulphate. The yield obtained by the process is nearly theoretical.

177,362. ETHYLENE DERIVATIVES, MANUFACTURE OF. W. Carpmal, London. From Farbenfabriken vorm. F. Bayer & Co., Leverkusen, near Cologne. Application date, February 23, 1921.

In recovering a small proportion of ethylene from a gaseous mixture such as coal gas, halogens or acid chlorides such as phosgene or thionyl chloride may be used, but the reaction is incomplete if the velocity of the gaseous current is too great or if the proportion of ethylene is very small. In this invention the reaction is facilitated by using a reaction medium consisting of highly active porous charcoal. The reaction may be further accelerated by mixing the charcoal with a halogen carrier such as a halide of antimony, sulphur, phosphorus, zinc, iron, or chromium. Ethylene halogenides are formed and may be used for the manufacture of ethylene glycol. The ethylene compound may be obtained from the charcoal by treating with superheated steam, and may be purified by fractional distillation. Detailed examples are given of the manufacture of ethylene chloride, ethylene bromide, and β -chloropropionyl chloride (by using phosgene).

177,444. TREATING WASTE OR OTHER LIQUORS CONTAINING FERROUS CHLORIDE, METHOD OF AND MEANS FOR. E. V. Chambers, The Manse, Lightcliffe, Yorks; T. C. Hammond, Hopewell, Lightcliffe, Yorks; and W. Sowden, Fernleigh, High Street, Cleckheaton, Yorks. Application date, June 14, 1921.

In treating waste ferrous chloride liquors, the liquor is usually neutralised by adding scrap iron and then evaporated to a dry or pasty condition before adding sulphuric acid to recover the hydrochloric acid and produce ferrous sulphate. In this process the liquor is not neutralised, and the process



177,444

is continuous. In the apparatus, which is illustrated in plan, the liquid is passed through filters *a* to a collecting tank *b*, and thence to a series of storage tanks *c*, where sulphuric acid is added in amount equivalent to the ferrous chloride present. The liquor then passes to an overhead tank *d*, from which it flows by gravity over a series of trays *f* arranged in cascade. The trays are heated by a furnace at the lower

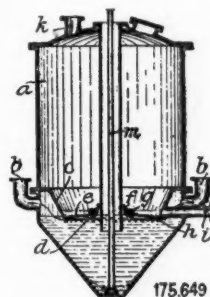
end *h*, and hydrochloric acid is evolved and drawn off by pipes *k* to a condenser *l*. The condensed acid and steam pass to a receiver *m*. The suction through the condenser is produced by connecting the top of the receiver *m* to the scrubbing tower *o* by a pipe *n*, and the top of the tower *o* to the stack *i*. The number of trays *f* and the rate of flow are adjusted so that the reaction is complete before the lowest tray is reached. The residual liquor passes to crystallising tanks *p* where ferrous sulphate crystallises out, and the liquor may then pass to a tank *q* from which it may be returned to the tanks *c* for retreatment.

NOTE.—Abstracts of the following specifications, which are now accepted, appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention: 155,546 (H. Scheibler) relating to sulphur preparations of the thiophene series from tar oils, see Vol. IV., p. 258; 155,775 (Stockholms Superfosfat Fabriks Aktiebolag) relating to acetaldehyde from acetylene, see Vol. IV., p. 286; 156,117 (H. O. Traun's Forschungslaboratorium Ges.) relating to vinyl compounds and polymerisation products, see Vol. IV., p. 313; 156,120 (H. O. Traun's Forschungslaboratorium Ges.) relating to vinyl halides, see Vol. IV., p. 314; 156,136 (H. O. Traun's Forschungslaboratorium Ges.) relating to hexamethylene tetramine and formaldehyde, see Vol. IV., p. 314; 156,139 (H. O. Traun's Forschungslaboratorium Ges.) relating to low-boiling chlorinated hydrocarbons, see Vol. IV., p. 314; 156,540 (Chemische Fabriken Worms Akt.-Ges.) relating to anthraquinone and derivatives, see Vol. IV., p. 376; 156,693 (E. Erdmann) relating to obtaining paraffin from lignite tar or shale tar, see Vol. IV., p. 377; 158,849 (l'Air Liquide, Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude) relating to synthesis of ammonia, see Vol. IV., p. 515; 159,866 (Wargöns Aktiebolag and H. J. Lidholm) relating to production of cyanamide, see Vol. IV., p. 567; 172,027 (H. Mehner) relating to cyanic compounds, see Vol. VI., p. 117.

International Specifications not yet Accepted

175,649. AMMONIUM SULPHATE SATURATORS. H. Egeling, 31, Prinz Regentstrasse, Weimar, near Bochum, Germany. International Convention date, February 17, 1921.

The lower part of the saturator *a* is provided with a conical member *c*, open at the bottom and having a serrated edge *d*. The liquid in the lower part of the saturator just covers the lower edge of the cone. The gas enters through inlets *b*, passes under the serrations *d*, and then travels radially



inwards below a disc *e* while in contact with the liquid. A constant level overflow *i* is provided. The gas finally escapes through a central aperture *f* into the upper part of the saturator and thence to an outlet *k*. Incrustation of salt on the edge of the cone *c* is prevented by a sprinkler *g*, the liquid from which passes through apertures *h*. Salt is discharged through the tube *m*.

175,963. DRY DISTILLATION. Maschinenfabrik Augsburg-Nürnberg Akt.-Ges., Nürnberg, Germany. International Convention date, February 21, 1921.

In dry distillation apparatus of the type in which the material passes through an inner horizontal rotary drum to preheat it, and then through a surrounding concentric drum, stresses in the structure are avoided by connecting the two drums rigidly together at one end only. The other end of the inner drum is allowed to slide freely through a ring formed as a guide.

LATEST NOTIFICATIONS

- 178,104. Effecting the chlorination of cellulose lyes. Schmidt, Dr. A. April 7, 1921.
- 178,106. Process of recovering the waste heat of gases and vapours. Zellstofffabrik Waldhof, Clemm, Dr. H., and Schneider, Dr. A. April 11, 1921.
- 178,121. Process for the treatment of viscose substances. Snia Soc. di Navigazione Industria e Commercio Reparto Viscosa. April 7, 1921.
- 178,126. Process of, and apparatus for low-temperature carbonisation of materials. Polysius, G. May 3, 1918.
- 178,409. Method of diffusing and disseminating poisonous gases. Van Meter, J. W. April 11, 1921.
- 178,422. Processes of rust-proofing by coating with cadmium. Udylyte Process Co. April 9, 1921.
- 178,455. Methods and apparatus for cooling gases. L'Air Liquide, Soc. Anon. pour l'Etude et l'Exploitation des Procédés. G. Claude. April 15, 1921.
- 178,467. Process for treating plant cultures with sulphur. Rupprecht, Dr. C. April 15, 1921.

Specifications Accepted, with Date of Application

- 155,246. Ores and the like, Method of treating. Moa Iron and Development Corporation. December 8, 1919.
- 155,836. Dispersoids, Process for manufacture of. H. O. Traun's Forschungslaboratorium Ges. February 8, 1919.
- 156,121. Vinyl sulphuric acid and homologues thereof, Process for the manufacture of. H. O. Traun's Forschungslaboratorium Ges. May 24, 1918.
- 156,140. Lubricating oils, Manufacture of. H. O. Traun's Forschungslaboratorium Ges. December 12, 1919.
- 156,170. Ammonium sulphate, Manufacture of. Koppers Co. May 10, 1918.
- 156,245. Catalytic oxidation of hydrocarbons into carbonyl compounds or acids, Process for. A. Wöhl. December 18, 1916. [Addition to 156,244.]
- 156,259. Fatty acids from fatty-acid mixtures, Process for recovery of. Byk-Guldenwerke-Chemische Fabrik Akt-Ges. June 27, 1916.
- 156,478. Furnaces. Nitrogen Products Co. January 27, 1919.
- 156,546. Sulphite liquor, Process for utilising concentrated waste. Dr. L. Stein. September 18, 1919.
- 156,591. Soap, Method of fabrication of. P. L. E. Pech. January 3, 1921.
- 157,793. Benzol hydrocarbons, Process of recovery of, from coke-oven gas. Dr. A. Hartmann. November 13, 1913.
- 165,094. Apparatus for evaporating liquids to dryness. K. L. E. Thunholm. June 21, 1920.
- 165,438. Saccharin, Process for manufacture of. Soc. Chimique des Usines du Rhône. June 25, 1920. [Addition to 153,520.]
- 165,446. 1-allyl-3 : 7-dimethylxanthine, Process for manufacture of. F. Hoffmann-La Roche & Co. Akt.-Ges. June 22, 1920.
- 165,779. 1-allyl-3 : 7-dimethylxanthine, Process for the manufacture of; easily, and neutrally soluble double compounds of. F. Hoffmann-La Roche & Co. Akt.-Ges. July 2, 1920.
- 170,575. Purifying gases by electricity, Process and apparatus for Siemens-Schuckertwerke Ges. October 22, 1920.
- 170,817. Carbon bisulphide in the working-up of viscose into artificial fibres, films, and similar products, Process for the recovery of. Dr. A. Kämpf. October 28, 1920.
- 177,819. Filtering-apparatus. E. W. W. Keene. October 4, 1920.
- 177,820. Extraction of soluble matter from powdered or crushed material or substances other than tanstuffs, Method of, and apparatus for. W. A. Fraymouth, J. A. Reavell, and Kestner Evaporator and Engineering Co., Ltd. October 5, 1920.
- 177,839. Concentration of ores containing elemental sulphur. T. R. Simpson and Minerals Separation, Ltd. December 2, 1920.
- 177,845. Gas-generators or producers. G. Hughes and W. Mitchell. July 28, 1921.
- 177,855. Gas cooling and purifying apparatus. J. W. B. Stokes and C. J. Waldie. December 31, 1920.
- 177,878. Producer-gas generators. H. W. Bamber and J. W. Parker. January 6, 1921.
- 177,946. Crushing or grinding ore, rock, cement, or the like, Machinery for. W. Graham and D. Honeywood. February 21, 1921.
- 178,046. Sulphate of ammonia, Manufacture of. R. Lessing. October 6, 1921.
- Christopher, J. E., and Kay, S. R. Apparatus for neutralising and drying sulphate of ammonia. 11,236. April 21.
- Cocksedge, H. E. Process and manufacture of a sodium compound and a composition containing same. 11,325. April 22.
- Consortium für Elektrochemische Industrie Ges. Manufacture of formaldehyde. 10,912. April 18. (Germany, April 18, 1921.)
- Davies, W. E. Carbonisation and/or gasification of fuels. 11,150. April 20.
- Dunstan, A. E. Treatment of liquid hydrocarbons. 11,405. April 22.
- Dunstan, A. E. Treatment of liquid hydrocarbons and purification of mineral oils. 11,406. April 22.
- Du Pont de Nemours & Co., E. I., and Marks, E. C. R. Process of manufacturing cyanides. 11,022. April 19.
- Elektrizitätswerk Lonza. Manufacture of aldol from acetaldehyde. 10,203. April 10. (Switzerland, May 4, 1921.)
- Farbenfabriken vorm. F. Bayer & Co. and Carpmel, W. Manufacture of azo-dyes. 11,037. April 19.
- Farbwerke vorm. Meister, Lucius, & Brüning and Imray, O. Y. Manufacture of therapeutically-active acridine derivatives. 11,034. April 19.
- Goldschmidt, H., and Stock, A. Process for electrolytically manufacturing compact metallic beryllium. 11,046. April 19.
- Hutton, H. W. Production of a soluble hydrocarbon. 10,449. April 12.
- Meter, J. W. van. Chlorinating fluids. 10,996. April 19.
- Metz, H. A. Complex arseno-stibino compounds, and process of making same. 10,183. April 10. (United States, April 21, 1921.)
- Mueller, M. E. Method of recovering hydrocyanic acid from gases. 10,174. April 10.
- Nitrogen Corporation. Process of ammonia synthesis, and catalyst therefor. 11,023. April 19. (United States, April 30, 1921.)
- Parker, F. and H. M. Dye-stuffs. 10,884. April 18.
- Paterson, A. Desulphurisation of oils, &c. 11,378. April 22.
- Plauson, H. Rotary filters. 10,121. April 10.
- Plauson's (Parent Co.), Ltd., and Hinchley, J. W. Disintegrators for producing colloidal dispersions. 10,567. April 13.
- Prior, W., and Riley, C. E. Selenium cells. 10,471. April 12.
- Schneider, G. R. Extraction of oil from seeds, nuts, &c. 10,568. April 13.
- Soc. Chimique des Usines du Rhône. Process for treating cellulose acetate before dyeing. 10,991. April 19. (France, February 10.)
- L'Air Liquide, Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude. Devices for bringing liquids and gases into contact. 11,169. April 20. (France, April 21, 1921.)
- Thwaite, A. H. Apparatus for simultaneously drying, grinding, and neutralising acid sulphate of ammonia salts. 11,196. April 21.
- Tootal Broadhurst Lee Co., Ltd., Foulds, R. P., and Barrett, F. L. Treatment of cellulosic fibres and fabrics. 10,565. April 13.
- Welford, R. Producing oils and by-products. 10,277. April 11.

Government Contracts

THE following were among the Government contracts let during March:

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).—*Electrodes*: The Quasi-Arc Co., Ltd., London. *Oil Fuel Pumping Plant*: Cochran & Co. (Annan), Ltd., Annan. (CIVIL ENGINEER-IN-CHIEF'S DEPT.).—*Asbestos, Cement, and Corrugated Sheets*: Bell's United Asbestos Co., Ltd., London. *Explosives*: Explosives and Chemical Products, Ltd., London.

WAR OFFICE.—*Fuel Oils*: British Petroleum Co., Ltd., London. *Zinc*: H. B. Barnard & Sons, London.

AIR MINISTRY.—*Conversion of Dope*: Cellon (Richmond), Ltd., London. *Furnace Fuel Oil*: Anglo-American Oil Co., Ltd., London.

CROWN AGENTS FOR THE COLONIES.—*Cement*: Ship Canal Portland Cement Manufacturers, Chester; Cement Marketing Co., Ltd., London; Tunnel Portland Cement Co., London.

Detonators, Blasting Powder, &c.: Curtis & Harvey, Ltd., London. *Drugs and Chemicals*: Howard & Sons, Ltd., Ilford. *Glass Boxes*: Chloride Electrical Storage Co., Ltd., London. *Oil*: Vacuum Oil Co., Ltd., London. *Paint*: Rowe Brothers & Co., Ltd., Liverpool.

H.M. PRISON COMMISSION.—*Drugs and Sundries*: Evans, Sons, Lescher & Webb, Ltd., Liverpool. *Soap, Hard, Yellow, and Carbolic*: John Knight, Ltd., London.

Swansea Meeting of the Institute of Metals

THE annual autumn meeting of the Institute of Metals will be held at Swansea on September 20-22. A ballot for the election of members and students desirous of participating in this and other meetings of the institute will take place on July 13. Membership particulars may be obtained from the Secretary of the Institute of Metals, 38, Victoria Street, London.

Applications for Patents

- Akt.-Ges. für Anilin-Fabrikation. Process for dyeing wool. 10,708. April 13. (Germany, November 7, 1921.)
- Akt.-Ges. für Anilin-Fabrikation and Bloxam, A. G. Process for dyeing furs, skins, feathers, &c. 10,913. April 18.
- Bengue, J. Stopper for glass containers for ethyl chloride, &c. 10,902. April 18. (France, August 11, 1921)
- British Cellulose & Chemical Manufacturing Co., Ltd., and Dickie, W. A. Manufacture of plastic materials. 11,257. April 21.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The weekly report contains only commodities whose values are at the time of particular interest or of a fluctuating nature. A more complete report and list are published once a month. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.

LONDON, APRIL 27, 1922.

TRADE has been somewhat quiet during the current week, and more especially so in the textile districts, which is probably accounted for by the unsettled conditions in that industry. Prices are on the whole steady and the undertone is healthy.

Export trade has been better, and there has been some inquiry in the market, and certain overseas markets are now improving on their ideas of price.

General Chemicals

ACETONE is a shade easier but in very fair request.
ACID ACETIC is being offered at lower prices to come forward, but the spot price is well maintained.
ACID FORMIC is steady.
ACID LACTIC is very firm, with supplies on the light side.
ACID OXALIC moves steadily into consumption at last quoted figure.
CREAM OF TARTAR has been in request and the price is well maintained.
COPPER SULPHATE has been much more active and the price is very firm.
FORMALDEHYDE is easy with a small demand.
LEAD ACETATE has been very active and the price is steady.
LEAD NITRATE is unchanged.
LITHOPONE is an improving market and the value is unchanged.
POTASSIUM CARBONATE is in small request and the price is maintained.
POTASSIUM CAUSTIC is idle.
POTASSIUM PERMANGANATE continues steady, with small regular business.
POTASSIUM PRUSSIAN is firm and very scarce.
SODIUM ACETATE has been more active.
SODIUM BICROMATE.—A quietly steady business has been transacted at current figures.
SODIUM BISULPHITE is firm, but supplies appear slightly more plentiful.
SODIUM NITRITE has been in better request.
SODIUM PHOSPHATE is in small demand.
SODIUM PRUSSIAN remains scarce and firm.
ZINC OXIDE has been in better demand at last quoted figures.

Coal Tar Intermediates

BUSINESS continues on quiet, steady lines, but more interest is noticeable on export account, and it is to be hoped that home and continental values are approximating more one to another.

ALPHA NAPHTHOL.—A few inquiries have been received and orders booked. The price is firm.

ALPHA NAPHTHYLAMINE.—A certain business is passing at last quoted price and current requirements are filled promptly from stock.

ANILINE OIL AND SALT continue to pass into consumption at makers' price.

BENZIDINE BASE is in fair demand, and the price is unchanged.

BETA NAPHTHOL has been inquired for both on home and export account, and looks rather more interesting than has been the case of late.

DIMETHYLANILINE is firm in price and is passing regularly into consumption.

DIPHENYLAMINE is very firm with only small quantities available.

"G" ACID is featureless.

"H" ACID continues in demand and the price is very firm. NAPHTHIONIC ACID AND NAPHTHIONATE OF SODA have been inquired for and the price is steady.

NITRO BENZOL is without special feature, but the usual orders have been placed.

PARADICHLOROBENZENE.—Orders have been received both on home and export account.

PARANITRANILINE continues firm, with regular business passing.

PARAPHENYLENEDIAMINE is without change in price.

RESORCIN is the turn weaker, but orders have been received.

Coal Tar Products

THE improvement indicated in our report of last week has been maintained for some products, particularly creosote and Carbolic.

90's BENZOL is plentiful, and is weak in price. It is worth about 2s. per gallon on rails at works.

PURE BENZOL is also in poor demand, and is not worth more than 2s. 6d. per gallon in the north and 2s. 10d. in the south.

CREOSOTE OIL is in slightly better demand, and is worth about 4½d. per gallon on rails for liquid oil in the north, and about 5d. per gallon in the south.

CRESYLIC ACID.—There have been several export orders in the market, and cresylic is well booked over May and June. The price remains 2s. per gallon on rails for the pale quality, while the dark quality is worth about 1s. 9d. per gallon on rails.

SOLVENT NAPHTHA is weak, and orders are few. It is not worth more than 1s. 10d. per gallon on rails.

HEAVY NAPHTHA is also uninteresting, and is quoted at 2s. per gallon on rails.

NAPHTHALENE has a poor inquiry, and is worth about £5 to £7 per ton for the crude quality, while the refined quality is worth about £15 per ton.

PITCH.—The market continues to be quiet, and orders for immediate despatch are scarce, while little interest is taken in business for the next season. To-day's quotations are 70s. to 72s. 6d. f.o.b. London, and 67s. 6d. to 70s. f.o.b. East Coast. Manufacturers appear to take little interest yet in the forward position.

Sulphate of Ammonia

There is no change in price. The home demand has been good, and the quantity available for export consequently reduced.

Current Prices

Chemicals

	Per	£	s.	d.		£	s.	d.
Acetic anhydride.....	lb.	0	1	10	to	0	2	0
Acetone oil	ton	77	10	0	to	80	0	0
Acetone, pure.....	ton	77	10	0	to	80	0	0
Acid, Acetic, glacial, 99-100%....	ton	55	0	0	to	60	0	0
Acetic, 80% pure	ton	47	0	0	to	48	0	0
Arsenic	ton	90	0	0	to	95	0	0
Boric, cryst.....	ton	60	0	0	to	65	0	0
Carbolic, cryst. 39-40%.....	lb.	0	0	6½	to	0	0	7
Citric	lb.	0	2	2	to	0	2	2½
Formic, 80%	ton	72	10	0	to	75	0	0
Gallic, pure.....	lb.	0	3	4	to	0	3	6
Hydrofluoric	lb.	0	0	8½	to	0	0	9
Lactic, 50 vol.....	ton	40	0	0	to	43	0	0
Lactic, 60 vol.....	ton	43	0	0	to	45	0	0
Nitric, 80 Tw.....	ton	30	0	0	to	31	0	0
Oxalic	lb.	0	0	8½	to	0	0	9
Phosphoric, 1.5	ton	43	0	0	to	45	0	0
Pyrogallol, cryst.....	lb.	0	6	6	to	0	6	9
Salicylic, Technical	lb.	0	0	10½	to	0	1	0
Salicylic, B.P.....	lb.	0	1	4	to	0	1	6
Sulphuric, 92-93%.....	ton	8	0	0	to	8	10	0
Tannic, commercial	lb.	0	2	9	to	0	3	0
Tartaric	lb.	0	1	4	to	0	1	4½
Alum, lump.....	ton	12	10	0	to	13	0	0
Alum, chrome.....	ton	30	10	0	to	32	0	0
Alumino ferric.....	ton	9	0	0	to	9	10	0
Aluminium, sulphate, 14-15%....	ton	12	0	0	to	13	0	0
Aluminium, sulphate, 17-18%....	ton	13	10	0	to	14	10	0

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

GLASGOW, APRIL 26, 1922.

BUSINESS during the past week, although still showing no marked improvement, has been fairly satisfactory.

Continental quotations still show a rising tendency, and potashes especially are quoted much higher, caustic potash being about £5 above the price quoted a week ago.

Prices of home products remain practically unchanged, and there is nothing of importance to note.

In coal tar intermediates and wood distillation products there is a lower tendency in price generally.

Industrial Chemicals

ACETONE.—The position is unchanged.

ACID ACETIC.—Glacial well maintained at £61, spot delivery, and supplies still scarce. 80% technical quoted £47 to £48 per ton. B.P. quality, £1 per ton more.

ACID BORACIC.—Crystals of granulated, £60 per ton. Powdered, £62 per ton. Usual demand for small lots.

ACID CARBOLIC.—Price steady at 5½d. per lb.

ACID HYDROCHLORIC.—Quantity in demand still poor. Price unchanged, 6s. 6d. per carboy ex works.

ACID OXALIC.—Moderate inquiry but little actual business. Steady at 8½d. per lb.

ACID SULPHURIC.—A few inquiries for export. Makers' prices unchanged. 144°, £4 per ton. 168°, £7 5s. per ton. Dearsenicated, £1 per ton more.

ACID TARTARIC.—Spot lots available at 1s. 3d. per lb.

ALUM, POTASH.—Quoted £16 per ton ex station, but spot lots to be had slightly cheaper.

AMMONIA, ANHYDROUS.—In little demand. Quoted at 1s. 6d. to 1s. 7d. per lb. ex works.

AMMONIA, MURIATE.—Grey galvanisers quality quoted £34 per ton, f.o.r.

AMMONIA, SALAMMONIAC.—Crystals remain unchanged at £58 per ton.

AMMONIA SULPHATE.—25½%, £15 10s. per ton. 25¾%, neutral, £16 13s. per ton, ex works, April/May delivery. Spot lots of inferior qualities available but at very high prices.

ARSENIC, WHITE POWDERED.—In little demand. Spot lots at £40 per ton, ex store.

BARIUM CHLORIDE.—Continental quotations of about £15 per ton. Spot lots offered at £16 per ton.

BARYTES.—Prices remain unchanged. Fine White quality £6 per ton, f.o.r. Grey from £4 per ton.

BLEACHING POWDER.—Home manufacturers' price unchanged, at £14 per ton ex station. Continental offers of £11 10s. c.i.f. U.K.

BORAX.—Crystal or granulated, £29 per ton. Powder, £30 per ton, ex station.

CALCIUM CARBIDE.—£18 per ton, ex store.

CALCIUM CHLORIDE.—Price unchanged, £6 10s. ex quay. Spot lots of continental make at slightly lower quotations.

COPPERAS, GREEN.—Offered at £4 per ton, in casks, f.o.r. in full wagon loads.

COPPER SULPHATE, 98/99%.—Some inquiry, £26 15s. per ton less 5%, carriage paid.

EPSOM SALTS.—No change in price. Commercial, £9 5s. per ton. B.P. quality, £10 10s. per ton.

FORMALDEHYDE, 40%.—Prices lower at £73 per ton. A few small lots on offer at £70.

GLAUBER SALTS.—Inclined to be easier at £5 10s. to £5 17s. 6d. per ton.

LEAD.—Red, £34 10s. per ton. White, £49 per ton. Little business passing.

LEAD NITRATE.—Quoted at £45 per ton.

MAGNESITE, GROUND CALCINED.—Price unchanged at £12 per ton ex store. Cheaper lots on offer at about £11 per ton.

MAGNESIUM CHLORIDE.—Spot lots £8 per ton, ex store. Continental offers inclined to be higher, at £7 5s. per ton, c.i.f.

NAPHTHALENE.—Price unchanged at £16 per ton, ex works, for sublimed flakes.

POTASSIUM BICHROMATE.—6½d. per lb. delivered. In moderate request.

POTASSIUM CARBONATE, 90/92%.—Spot lots still available at £26 per ton. Continental quotations much higher.

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POTASSIUM CAUSTIC, 88/92%.—£34 per ton ex store. Continental makers quoting £35 per ton, c.i.f. U.K.

POTASSIUM NITRATE (Saltpetre).—Price steady at about £37 per ton, spot delivery.

POTASSIUM PERMANGANATE.—B.P. quality on offer at 10½d. per lb. ex store. Fair inquiry.

POTASSIUM SULPHATE, 90%.—Offered at £15 per ton f.o.b.

SODIUM ACETATE.—Quoted at £26 per ton. Practically no demand.

SODIUM BICARBONATE.—Remains unchanged at £11 per ton ex station. M.W. quality, £10.

SODIUM BICHROMATE.—Makers' price unchanged at 5½d. per lb. Cheaper lots on offer.

SODIUM CARBONATE (Alkali).—£9 12s. 6d. per ton ex station. (Soda Crystals) £6 per ton ex quay or station. Usual local demand.

SODIUM CAUSTIC.—76/77%, £25 10s. 70/72%, £23 10s. 60%, £26 5s. 98/99% Powdered, £29 to £30. One or two inquiries for export.

SODIUM HYPOSULPHITE.—Commercial quality, £14 to £15 per ton. Pea Crystals, £21 ex store. Fair inquiry for Pea Crystals.

SODIUM PRUSSIAN.—Price, 9½d. per lb., but cheaper spot lots on offer. Little demand.

SODIUM SILICATE, 140°.—Makers' prices unchanged. £10 to £11 per ton. Moderate inquiry.

SODIUM SULPHATE (Saltcake 95%).—Makers' prices unchanged at £4 per ton. One or two spot lots for export at reduced prices.

SODIUM SULPHIDE.—60/62% solid, £20 per ton. Quoted at £19 10s. per ton, f.o.b., for export, but little inquiry.

SULPHUR.—Flowers, £14; Ground, £13; Rock, £12; Roll, £13. Ex store. Usual local demand for small quantities.

SULPHUR MONOCHLORIDE.—Offering at £27 per ton carriage paid. Very small demand.

TIN CRYSTALS.—No change in price. 1s. 2d. per lb.

ZINC CHLORIDE.—A few inquiries for export. Quotations for 98/99% of £21 10s. f.o.b. continental ports.

NOTE.—The foregoing prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

BENZIDINE BASE.—Inquiries for home trade. 6s. 6d. per lb. 100% basis.

BENZOL.—Offering more freely. Crude, 1s. 6d. per gallon. 90's, 2s. 3d. per gallon. Pure, 2s. 6d. per gallon.

BETA NAPHTHOL.—Weaker, 1s. 3d. per lb. carriage paid.

DIANISIDINE HYDROCHLORIDE.—Some small inquiry. Price 20s. per lb. 100% basis.

PARADICHLOROBENZENE.—Some inquiry. £50 per ton, carriage paid, casks included.

PARANITRANILINE.—Several inquiries. Price, 3s. 6d. per lb., ton lots and up. Small lots, 3s. 7d. per lb.

PHTHALIC ANHYDRIDE.—Small inquiry. 2s. 10d. per lb.

SALICYLIC ACID.—Technical: Few inquiries. Price, 8½d. per lb. f.o.r. works.

XYLENE (Commercial).—Some inquiry. Price, 3s. 2d. per gallon, f.o.r. works, drums returnable.

Bibliography of Literature on Sampling

So far as is known there is no complete bibliography on sampling, and a new work compiled by W. J. Sharwood and M. W. von Bernewitz, published by the U.S.A. Bureau of Mines, will therefore be welcome. It contains nearly eleven hundred references, some dating back thirty years, on sampling at mines, mills, smelters, power plants, pumping stations, and refineries. For convenience it includes a few references to methods for sampling such materials as leather belting in mills, salt impregnated soils, and mine waters. All the important technical journals, including some of those published in foreign countries, and mining and metallurgical text books, have been studied for anything concerning sampling. The arrangement is alphabetical by authors' names, and the items are numbered serially. A copy of this bibliography can be obtained on application to the Director, Bureau of Mines, Washington, D.C., U.S.A.

German Chemical Trade Notes

FROM OUR OWN CORRESPONDENT

Berlin, April 24, 1922.

BUSINESS has been quiet this week, the Easter holidays having caused a considerable easing-off of inquiries. Offerings at lower quotations have been coming somewhat more freely from speculative holders, but the market was unsettled. A slightly firmer tendency was noticeable in goods for forward delivery and in those which are becoming increasingly scarcer.

Industrial chemicals had a quiet week, although alkalis, salt cake, and soda ash met with a certain amount of interest. Consumers generally are not prepared to commit themselves very heavily while prices remain at their present high levels. Potash sales during the current month show a not inconsiderable increase on those of the previous month.

Coal tar products were inclined to be firmer, but no heavy buying is reported. It is probable that quotations will advance again shortly as a result of recent increases in working expenses in the mining industry.

The following quotations are given in marks per kilogram (d. = domestic price, e. = export price):

ACIDS.—Acetic, 80%, scarce at 35 mk. d.; 45 mk. e.; glacial, 98/100%, is meeting with interest from foreign buyers at 56 m. d.; 64 mk. e. Acetyl-Salicylic, 280/290 mk. d.; 350/360 mk. e. Benzoic, 120 mk. d.; 150 mk. e. Boric, crystallised, 82 mk. d.; 83/89 mk. e., in fair request. Citric, 325 mk. d.; 340 mk. e. Oxalic, 98/100%, crystallised, 50 mk. d.; 80/82 mk. e. Salicylic, in good demand at 145/160 mk. d.; 200 mk. e. Tartaric, returns are satisfactory owing to increased demand; powdered and crystallised, 165 mk. d.; 200/215 mk. e.

INDUSTRIAL CHEMICALS.—Alum, chrome, 15%, 37/40 mk. d.; 45 mk. e.; potash in lumps, 16.50 mk. d.; 18 mk. e.; potash, crystal, powder, 10 mk. d.; 15/16 mk. e. Alumina Sulphate, 14/15%, 8.25/9.50 mk. e.; 17/18%, 10.75 mk. e. Ammonia Carbonate, powdered, in good demand, at 19.50 mk. d.; 30/35 mk. e.; in lumps, 30 mk. d.; 38 mk. e. Barium Chloride, 18 mk. d.; 23/27 mk. e. Bleaching Powder, 80%, 8 mk. d.; 13 mk. e. Borax.—The convention have reduced their prices; market-prices are: crystallised, 40 mk. d.; powdered, 41 mk. d. Calcium Chloride, 70/75%, 6.50 mk. e.; 90/95%, scarce at 10 mk. e. Copperas, 4.50 mk. d.; 6.25 mk. e. Copper Sulphate, 98/100%, 36 mk. d.; 38 mk. e. Formaldehyde, 30%, 68 mk. e.; 40%, 55 mk. d.; 79 mk. e. Glauber's Salt, crystallised technical, 3.50 mk. d.; 4.50 mk. e. Glycerine, chemically pure, 28°Bé, in strong demand for export, 105/115 mk. e.; 95/105 mk. d. Magnesium Carbonate, 45 mk. d. Magnesium Chloride, fused, 6.50 mk. e. Potash Carbonate, 96/98%, calcined, 26.50 mk. d.; 39 mk. e. Potash, Caustic, 88/92%, 27/28 mk. d.; 40 mk. e.; liquor, 50°Bé, 14 mk. d.; 21 mk. e. Potassium Chlorate, factory stocks are exhausted; spot quotations at 35/36 mk. d.; 42 mk. e. Potassium Metabisulphite, better buying interest at 50 mk. e. Potassium Permanganate, increased buying movement from abroad at 80/85 mk. e.; 72 mk. d. Salt Cake, loose, 4/4.50 mk. d.; 8 mk. e. Soda, crystallised, 6.50 mk. d. Soda Ash: there are still restrictions as to imports of foreign makes of this necessary and urgently-wanted material, despite the inability of the soda syndicate to cover the demand. Prices are around 14 mk. d. Soda Benzoate, 110 mk. d. Soda Bicarbonate, 8.50 mk. d.; 20/21 mk. e. in good demand. Soda, Caustic, 125/128°, 34/36 mk. d.; 31/32 mk. e.; liquor, 13.50 mk. d. Sodium Silicate, 38/40°, 6.75 mk. e. Sodium Sulphide, 30/32%, 10.50 mk. d.; 14.50 mk. e.; 60/62%, 21.50 mk. d.; 24.75/25 mk. e.; supplies are scarce. Tetralin.—sales were satisfactory, and supplies sufficient for the demand. Present quotations are: tetralin, 21.40 mk. d. in tank-car lots; tetralin, extra (Dekalin), 29 mk. d. Zinc Chloride, 23 mk. d.; 29 mk. e. Anthracene, 30%, 1.20 mk. d. Benzaldehyde, unchanged at 85 mk. d.; 100 mk. e. Naphthalene, pure, in balls, 17.50 mk. d.; 20 mk. e.; in flakes, 17 mk. d.; 19 mk. e.; crude, No. 2, 3 mk. d.; No. 3, 2.50 mk. d.; No. 4, 2.30 mk. d.; No. 5, 1.50 mk. d.; sludge, 1 mk. d. Bone Glue, 62 mk. d. Lead, red, 36 mk. d.; 44 mk. e.; Lead, white, powdered, 43.50 mk. d.; 45 mk. e.; in oil, 43 mk. d.; 44 mk. e. Sugar of Lead, 40 mk. d.; 44 mk. e. Litharge, 39 mk. d. Lithopone, 30%, red-seal, 17.75/19 mk. d.; 25 mk. e.; considerable business for export. Zinc white, red-seal, neglected at 36 mk. d.; 43 mk. e.; green-seal, 37 mk. d.; 46 mk. e. Potassium Bichromate is very scarce at 70 mk. d.; 75/80 mk. e. Potassium Prussiate, yellow crystallised, 165 mk. d. Sodium Hyposulphite, 14.75 mk. d.; 19/19.25 mk. e. Sodium Prussiate, yellow, scarce at 145 mk. d.

The Building Exhibition

IN addition to the exhibits at the Building Exhibition referred to in THE CHEMICAL AGE last week was that of George Waller & Son, Ltd., of Phoenix Ironworks, Stroud, Gloucestershire, who specialise in blowers, exhausters, compressors, pumps, sludge elevators, coke-breaking and washing plants, &c. Their exhibit included concrete-mixers of various capacities, clinker-breakers, pumps, gas- and oil-engines.

Catalogues Received

C. E. ROGERS.—A booklet issued by Mr. C. E. Rogers, of Morley House, 26, Holborn Viaduct, London, gives interesting facts concerning the Merco Nordstrom Plug Valve, the patent rights of which are controlled by the inventor, Mr. S. J. Nordstrom and the Merrill Co., of San Francisco, U.S.A. This valve is claimed to eliminate valve leaks in lines subjected to heavy wear, another advantage being that the full pipe area is exposed to the flow when open. The underlying principle of the valve is the combination of lubricant ducts and a lubricant chamber at the base of the plug. These are so placed that when pressure is applied to the lubrication screw, the plug is lifted from its seat and allowed to turn. Simultaneously lubricant is distributed from the grooves and grease chamber over the seating surface. An asbestos packing lined with anti-friction metal is inserted between the bearing surface and the cover. A visible lug is cast as an integral part of the cover, and fits into a recess in the shank of the plug, the two together serving as a positive stop in opening or closing the valve. This stop, while indicating to the operator the direction in which to move the plug for opening or closing, also prevents it from being turned more than 90°, and thus ensuring that the lubricant ducts will not be exposed to the fluid passing through the valve. In addition to a number of half-tone illustrations of various types of valves, the booklet gives sectional views and tables of dimensions.

CENTRIFUGAL SEPARATORS, LTD.—Substantial reductions in the prices of their standard 36 in. centrifugal separators are notified in a four-page leaflet recently issued by Centrifugal Separators, Ltd., of 8, Idlesleigh House, Caxton Street, Westminster, London. A diagrammatic illustration (in colours) shows very clearly the working and construction of the standard model complete with driving gear, which has been produced for use where space is limited and above-ground foundations are required, and where there is no counter-shaft from which the separator can conveniently be driven.

MANLOVE, ALLIOTT, & CO., LTD.—The firm have issued a new catalogue (No. 512) illustrating and giving full particulars of their hydro-extractors or centrifugals specially manufactured for the chemical industry. The booklet, which is attractively printed and arranged, contains a table giving the approximate capacity of the baskets for various kinds of materials, and a sectional drawing showing the internal construction of the firm's "Standard" hydro-extractor pan and basket with bearings in the dome bracket. Approximate leading particulars relating to the under-driven "bolted-down," under-driven "suspended," steam-driven, electric (under and top-driven), and the "B B" type top-driven hydro-extractors, and illustrations of various types of wire guards and of baskets are also supplied. Copies of this booklet may be obtained on application to the company at Blooms Grove Works, Nottingham.

R. W. GREEFF & CO., LTD.—A new pigment, Titanium White, is described in a booklet bearing that title, issued by R. W. Greeff & Co., Ltd., of Thames House, Queen Street Place, London. Mainly composed of titanium oxide, it is only quite recently that its production on an industrial scale has been rendered possible by the discovery of an economical process for extracting it from the mineral Ilmenite. Interesting facts are given regarding the colour, fineness, lightness, durability, inertness, drying power, obscuring power, non-toxicity, &c., of the paint, together with a comparative table of weights of paint to unit area. Manufactured in Norway, by the Titan Co., A/S, Norway, Titanium White is sold by R. W. Greeff & Co., who are the sole agents for Great Britain.

A. C. WELLS & CO.—A new continuous oil and water separator forms the subject of a leaflet issued by A. C. Wells & Co., of 102-5, Midland Road, St. Pancras, London. This simply-designed apparatus has been devised in order to save the wastage occasioned by discarding oil, mixed with, perhaps, a large percentage of water, and where the initial cost of large plant for separation is deemed unwarrantable. According to the manufacturers' description the separator is made entirely of copper and brass, is furnished with 1 in. outlets, and is supplied with suitable lengths of hose. It consists of two compartments, the bottom chamber being first charged with water, when the mixture of oil and water is supplied to the top container through a suitable gauze. A special regulator with gauges for light or heavy oil leads the supply through lateral holes in a downtube to a separating compartment beneath, where, by fixed differences of levels, oil or water is diverted to its proper discharge tube.

Company News

ANGELA NITRATE CO.—A further dividend of 10 per cent. less tax, is payable on May 12, making 15 per cent. for the year 1921.

BELL'S UNITED ASBESTOS CO., LTD.—A balance dividend of 1s. 6d. per share has been declared on the ordinary shares, making a total distribution of 10 per cent. for the year; £34,013 is carried forward.

NITRATE RAILWAYS CO., LTD.—The fortieth ordinary general meeting will be held at Winchester House, Old Broad Street, London, on Tuesday, May 9, at 11 a.m. The transfer books are closed until that date.

TEAM BY-PRODUCT COKE CO.—The accounts for the year to November 30 last show a loss, after providing for taxation, of £29,428. After deducting £27,399 brought in, there is a debit balance of £2,029 to be carried forward.

ANGLO-CHILIAN NITRATE & RAILWAY CO.—Coupons for the 4½ per cent. consolidated mortgage bonds due on May 1 will be paid on and after that date at the Anglo-South American Bank, 62, Old Broad Street, London. Dividends of 2s. per preference share (being 10 per cent.) and 6s. per ordinary share (being 10 per cent.), both free of tax, are payable on May 12, making 15 per cent., free of tax, on both classes of shares for 1921. The transfer books are closed until May 11.

BRUNNER, MOND, & CO., LTD.—Dealings in the following securities have been specially allowed by the Stock Exchange Committee under Rule 148A. These securities will rank *pari passu* with those in which special settling days have already been appointed as soon as they are identical and the certificates are ready for distribution, and with those for which an official quotation has already been granted as soon as they are identical and are officially quoted: 38,088 ordinary shares of £1 each, fully paid, Nos. 9,608,954 to 9,647,041.

EVANS, SONS, LESCHER, & WEBB, LTD.—The accounts for 1921 show a loss of £385,764, to which is added directors' fees, £6,667, making £392,431. After deducting the reserve (£110,000), a debit of £282,431 is carried forward. The report states that drastic steps have been taken to reorganise the business to meet existing conditions, and large economies have been effected. The accounts include repayments of E.P.D. received, but the total claim is not yet settled and some further repayment is expected. A dividend of 5 per cent. was paid for 1920.

UNITED ALKALI CO., LTD.—Moving the adoption of the accounts for the year, 1920, Mr. Max Muspratt, on Tuesday, said that in spite of the slump at the end of the year the gross profit was £710,000. It was hoped that the accounts for 1921 would be presented at an early date. A dividend of 4s. per share was declared on the £10 preference shares, making, with the interim dividend paid in January last, a dividend of 4 per cent. on account of the 7 per cent. due for 1921, less income tax. The meeting was formally adjourned to a date to be fixed for the reception of the accounts and balance-sheet for 1921. A report of the chairman's speech appears on page 558.

AGUAS BLANCAS NITRATE CO.—The gross profit for 1921 was £48,109, plus interest, discount, income from investments, and transfer fees £2,563, making £50,672, less administration expenses £3,357, provision for income and corporation profits taxes £5,000, transferred to reserve £6,941, leaving £35,374, to which is added £37,780 brought in, making a total of £73,154. This is applied to a final dividend of 50 per cent., less tax, making 70 per cent., and extra remuneration to the directors, £900, leaving to be carried forward £39,179. The oficina has remained closed since January, 1921, and will not be reopened until the market is more normal. The annual meeting will be held at River Plate House, London, on May 11 at 2.30 p.m.

LEVER BROTHERS, LTD.—A meeting of first mortgage debenture stockholders on April 20 accepted unanimously a resolution which the chairman (Mr. H. R. Greenhalgh) explained would enable the company to make further stock issues at a lower rate of interest than 7 per cent., and to appoint an earlier date for stock redemption than the present trust deed provided for. It was also proposed to provide for separate portions of the sinking fund being appropriated proportionately to the various classes of stock issued. Their object was to take advantage of the improved money market conditions. No power was given to vary in any way the terms

and conditions of the first four millions of debenture stock already subscribed for, and the proposals had the approval of the trustees.

SALAR DEL CARMEN NITRATE CO., LTD.—The gross profit for 1921, including interest and transfer fees, was £88,831. From this have to be deducted London office charges, £4,769; reserve for income and corporation profits taxes, £28,300, leaving a net profit of £55,762; which, with £8,615 brought in, makes a total of £64,377. The directors recommend a further dividend of 15 per cent., less tax, making 20 per cent. for the year; placing £10,000 to reserve; allotting £5,000 to the reduction of the plant and machinery account, leaving to be carried forward, £18,577. Profit has been taken in the accounts on 231,000 quintals of nitrate, and the stock unsold at December 31 last (271,387 quintals) has been valued in the balance sheet at cost. The annual meeting will be held at Winchester House, London, on May 4, at 11.30 a.m.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIAL.	REF. No.
Sydney	Chemicals in bulk	454
Auckland	Chemicals	460
Copenhagen ..	Safe explosive materials	D.O.T. 48901 S.C.(A)2
Copenhagen ..	Oils and tallow	D.O.T. 5455 /F.R./ S.C.
Trentemoult-les-Nantes..	Sulphate of copper	464
Stockholm ..	Oils	474
New Orleans..	Chemicals, drugs, &c.	D.O.T. 152 44/F.W. S.C.2
Mexico	Chemicals	—

Tariff Changes

GOLD COAST.—Opium, morphine, and other similar dangerous drugs, may only be imported under a certificate from the Director of Medical and Sanitary Services, Accra, to the effect that the drugs are required exclusively for scientific and medical purposes. The certificate must be sent to the intending United Kingdom exporter, who should forward it to the Home Office in order to obtain an export licence.

AUSTRALIA.—The exportation of metals, alloys, and minerals is prohibited except with the written permission of the Minister for Trade and Customs.

FRANCE.—Acetone, crude methyl alcohol (methylene), and rectified methyl alcohol may be exported or re-exported from France without special authorisation.

ITALY.—Revised regulations provide that raw linseed oil having an acidity (calculated in oleic acid) of not less than 4 per cent. may be imported at the reduced duty of 10 lire (gold) per 100 kilograms without being denatured.

SPAIN.—It is proposed to increase the import duties on sugar, glucose, liquid caramel, and similar products.

UNITED STATES OF AMERICA.—According to information from H.M. Ambassador at Washington, the rates of the new Tariff Revision Bill are higher than those of the present Tariff, and more nearly approximate to those of the Tariff of 1909, although slightly higher on the average. The specific rates of the Committee's Bill are generally higher than those of the "House" Bill, but the *ad valorem* rates are lower owing to the rejection by the Committee of the so-called "American Valuation" systems for the assessment of *ad valorem* duties, and the substitution of foreign values as prescribed in the Emergency Tariff Act of May 27, 1921.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

D.L. MANUFACTURING CO., 68A, Western Road, Plaistow, disinfectant makers, £11 15s. 10d. February 7.
 MONARCH DISINFECTANT CO., 16, Kenmore Road Yard, Hackney, disinfectant manufacturers, £13 17s. 1d. February 21.
 NOBLE, E. D., 84, South Church Street, Southend-on-Sea, chemist, £19 15s. 5d. March 1.
 ROYSTON, J. A., 112, Hill Street, Sheffield (trading as J. E. ROYSTON), druggist, £19 17s. 8d. February 22.
 SKEAT, Charles, 609, High Road, Tottenham, chemist, £19 15s. 5d. February 24.
 WILLSON, W. H., Bradford-on-Avon, chemist, £13 16s. 1d. February 21.
 WOODBROOK DRUG CO., 65, Church Lane, Wolverhampton, wholesale chemist, £11 7s. 7d. February 23.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

BALDWIN (G.) & CO., LTD., London, chemists.—Registered April 7, charge to bank; charged on 16, Plumstead Road, Woolwich; also registered April 13. £2,800 debentures; present issue £1,800; general charge, subject to charge on 16, Plumstead Road, Woolwich. *£2,600. August 31, 1921.
 BUZZARD GLASS WORKS, LTD., London.—Registered April 12 £2,000 debenture, to A. J. J. Arnold and another, 124, Tottenham Court Road, W., sand merchants; general charge. *Nil. January 30, 1922.
 CATALYTIC CHEMICAL CO., LTD., Southall.—Registered April 13, £500 debentures part of £10,000; general charge.
 CATTO (A. & N.), LTD., Ilford, chemists.—Registered April 8, mortgaged to bank. *—, July 26, 1921.
 HALLS GLUE AND BONE WORKS, LTD., Nottingham.—Registered April 5, £12,000 debenture; general charge. *Nil. December 28, 1921.
 LEIGHTON LABORATORIES, LTD., London, chemists.—Registered April 13, £200 debenture; general charge.
 SOUTH AFRICAN CARBIDE AND BY-PRODUCTS CO., LTD., London.—Registered April 8, trust deed dated April 7, 1922, securing £20,000 prior lien debenture stock, present issue £12,000. *Nil. January 13, 1921.
 SURREY CHEMICAL CO., LTD., London.—Registered April 5, £1,000 debentures; present issue £200; general charge. *—, March 29, 1920.

London Gazette

Companies Winding Up Voluntarily

VEGETABLE OIL AND LARD COMPOUND REFINERS, LTD. F. Morse, 1 and 2, Great Winchester Street, London, appointed liquidator, and authorised to consent to the registration of a new company to be named Vegetable Oils and Margarine, Ltd. Meeting of creditors at Winchester House, Old Broad Street, London, Tuesday, May 9, at 10.30 a.m. NOTE.—This notice is given in compliance with the Companies (Consolidation) Act, 1908. Being a reconstruction, all creditors are to be paid by the new company.

PANGON CHEMICAL SYNDICATE, LTD. W. C. Black, 17, King's Terrace, Southsea, appointed liquidator. Meeting of creditors at the office of the liquidator, Tuesday, May 2, at 3.15 p.m.

Bankruptcy Information

ALEXANDER, Louis Victor, 107, Fore Street, Saltash, Cornwall, trading as the EAST CORNWALL DRUG CO., drug store keeper. First meeting May 1, 3 p.m. 7, Buckland Terrace, Plymouth. Public examination, May 26, 11 a.m., Western Law Courts, Guildhall, Plymouth.
 STEVEN, George, 118, Chorlton Road, Old Trafford, under the style of G. STEVEN & CO., manufacturing chemist. Receiving order, April 19. Debtor's petition.

Partnerships Dissolved

ANDREWS, Clifford; ROSTRON, Robert Henry; and NICHOLSON, Edmund, manufacturing chemists, 507, Hilton Lane, Little Hulton, Lancaster, under the style of the UNION CHEMICAL CO. By mutual consent as from March 31, 1922. Debts received and paid by R. H. Rostron.
 GREENWOOD, Thomas Branson, and NICHOLS, William, soap manufacturers, Manor Works, Eccleshill, Bradford, and 7, Greek Street, Leeds, under the style of THE BUSY SOAP AND CHEMICAL CO. By mutual consent, as from April 20, 1922.

Edinburgh Gazette

DENNISTOUN GLASS WORKS, LTD. (in liquidation). A petition for the voluntary winding up to be continued, but under the supervision of the court, has been presented by the Kinghorn Bottle Co., Ltd.

New Companies Registered

A. A. CHEMICAL CO., LTD., 1, Kinglake Street, Old Kent Road, London. Consulting, analytical, and manufacturing chemists, chemical and metallurgical engineers, drug and chemical exporters, &c. Nominal capital, £500 in 400 8 per cent. cumulative preference shares of £1 each, and 2,000 founders' shares of 1s. each.
 HYDROCARBONS, LTD.—To adopt an agreement with J. A. C. Porter for the acquisition of his rights in any invention for improvements in or relating to the treatment of liquid hydrocarbons. Nominal capital, £5,000 in £1 shares. A subscriber: A. O. Greeves, 22, Narcissus Road, West Hampstead, London.
 LANCASHIRE SOAP & CHEMICAL CO., LTD. Manufacturers of and dealers in soaps, soap powders, cleansing and polishing preparations, manufacturers and refiners of and dealers in waxes, fats, oils, &c. Nominal capital, £20,000 in £1 shares. A director: C. Briede, 34, Aberdour Road, Goodmayes, Essex.
 LUBRICATING OIL IMPORT CO., LTD., 8B, Rumford Place, Liverpool. Lubricating oil and grease importers, manufacturers, refiners, &c., fat and chemical merchants and importers. Nominal capital, £100 in £1 shares.
 PRIMO DRUG CO., LTD., 5, Bury New Road, Manchester. Manufacturing chemists, &c. Nominal capital, £3,000 in £1 shares.
 PUMILAVE MANUFACTURING CO., LTD., Victoria Works Briscoe Road, Colliers Wood, London. Soap manufacturers, &c. Nominal capital, £1,000 in £1 shares.
 RADIOR CO., LTD. Manufacturers of toilet and medicinal preparations. Nominal capital, £100 in £1 shares. A subscriber: W. G. S. Naunton, Hurstleigh, Redhill, Surrey.
 SIRKIS & HARTSTEIN (ROUMANIA), LTD., 9 & 10, Fenchurch Street, London. Manufacturers of and dealers in soaps, oils, chemicals, perfumes, &c. Nominal capital, £2,080 in 2,000 "A" ordinary shares of £1 each, and 160 "B" ordinary shares of 10s. each.
 VARCOES CHINA CLAYS, LTD., Bank Buildings, High Cross Street, St. Austell, Cornwall. Preparers of china clay, chemicals, and cognate substances. Nominal capital, £55,000 in 40,000 ordinary and 15,000 7½ per cent. non-cumulative participating preference shares of £1 each.

